



Charles E. Kellogg

DOWN-UNDER JOURNAL

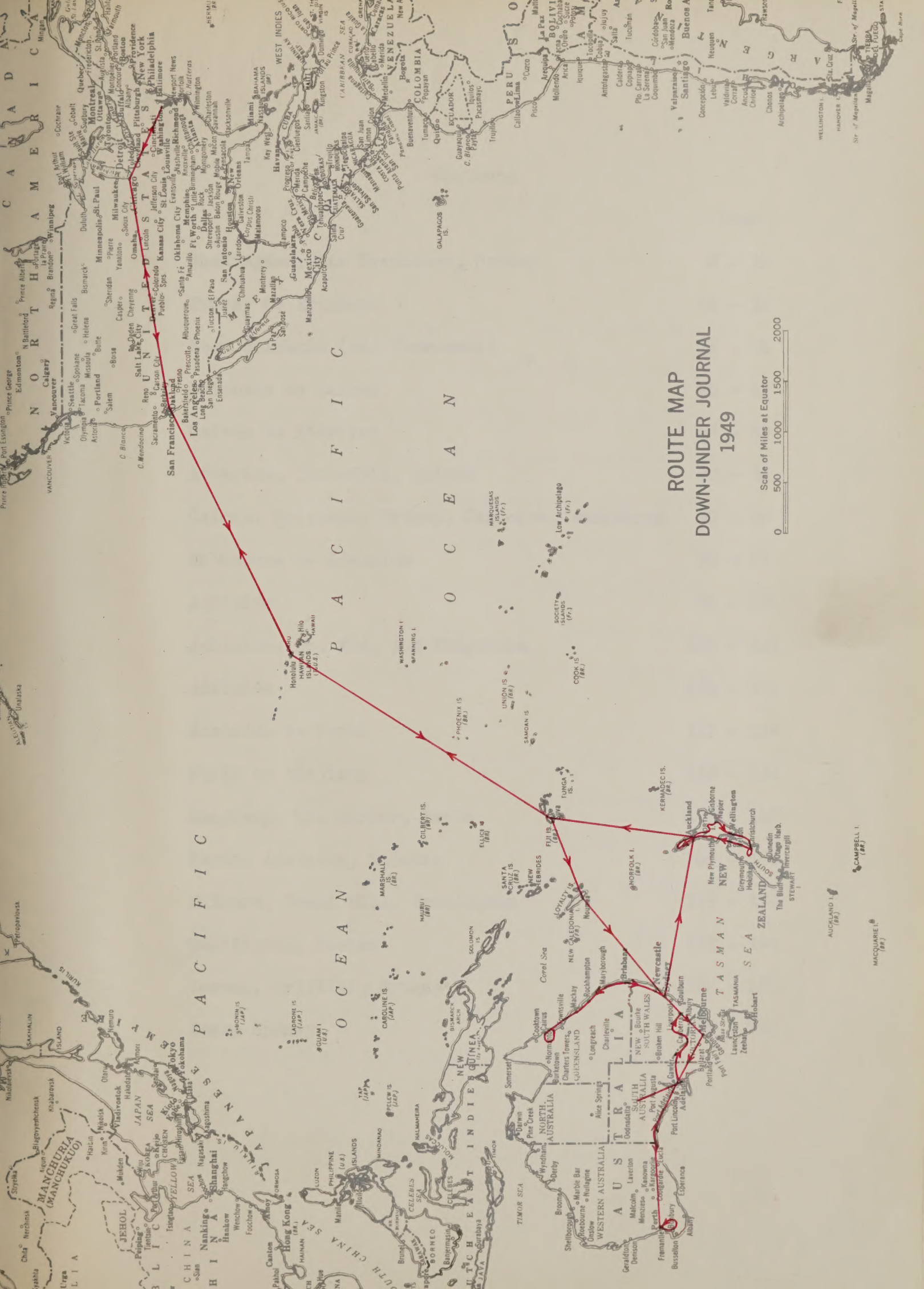
Volume I

Australia

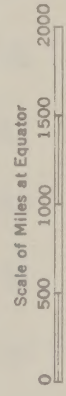
Charles E. Kellogg

1949

ROUTE MAP
DOWN-UNDER JOURNAL
1949



ROUTE MAP
DOWN-UNDER JOURNAL
1949



Contents

	Page
Washington, San Francisco, Sydney	2 - 14
Sydney to Brisbane	14 - 16
Near Brisbane (and Toowoomba)	17 - 44
Brisbane to Cairns	44 - 47
Cairns to Atherton	48 - 69
Atherton, Innisfail, Cairns	70 - 81
Cairns, Brisbane, Sydney, Canberra, Melbourne	82 - 89
Melbourne to Adelaide	90 - 93
Adelaide	94 - 101
Adelaide, Mt. Eba, and Bulgunnia	102 - 113
Adelaide	114 - 117
Adelaide to Perth	117 - 118
Perth to Manjimup	119 - 132
Manjimup, Mt. Barker, Perth	133 - 148
Perth, Adelaide, Mildura	149 - 154
Mildura, Swann Hill, Deniliquin	155 - 170
Deniliquin, Leeton	171 - 181
Leeton, Griffith, Sydney	182 - 184
Leave Sydney	185 - 186

Note: Numbered entries (as 104/3) refer to notes at the end of the volume or based on his comments.

Contents

185 - 186	Leave Sydney
182 - 184	Leeton, Griffith, Sydney
171 - 181	Deniliquin, Leeton
155 - 170	Mildura, Swan Hill, Deniliquin
149 - 154	Perth, Adelaide, Mildura
133 - 148	Manjimup, Mt. Barker, Perth
119 - 132	Perth to Manjimup
117 - 118	Adelaide to Perth
114 - 117	Adelaide
102 - 113	Adelaide, Mt. Roe, and Bulgannina
94 - 101	Adelaide
90 - 93	Melbourne to Adelaide
82 - 89	Calara, Brisbane, Sydney, Canberra, Melbourne
70 - 81	Acheron, Inland, Calara
49 - 69	Calara to Acheron
44 - 47	Brisbane to Calara
37 - 44	Near Brisbane (and Toowoomba)
34 - 36	Sydney to Brisbane
2 - 34	Washington, San Francisco, Sydney

Down-Under Journal

1949

The organizing committee of the Seventh Pacific Science Congress in New Zealand cordially invited me to attend the Congress and serve as chairman of the program on soil classification. I declined because of the great press of other work. Those organizing the Congress renewed their invitation with emphasis, and it was decided in the Department of Agriculture that I should go. Since the Congress was to be held in New Zealand during February, it seemed wise to spend some time in Australia prior to the Congress.

This journal covers the entire trip -- both Australia and New Zealand. It is a record of notes taken on the spot, often in a great hurry. Likely there are errors. (Unfortunately, my black-and-white film was defective, so many photographs are poor, but good kodachromes are on file.) Some of the opinions formed at the time may be changed with further information and reflection. [These notes are not to be quoted except with permission in writing.]

no

Note: Numbered asterisks (as 10*) refer to notes at the end from C. G. Stephens or based on his comments.

January 4 but has no luck with the Santa Fe. So I take

About 10:30 p.m. I leave home again for a long trip. I drop to sleep just before the train pulls out of Washington at midnight.

January 5 culture convention. I go over to the Palmer House,

Although I slept well, I cannot stay in bed and am up for breakfast at 8:00 on a dreary, foggy morning. From the Chicago papers I see that the trains are blocked in the mountains to the west and I wonder whether I shall be able to get through to San Francisco and make my plane to Sydney. Later, the papers have stories that all the trains on the Northwestern and Union Pacific are stranded in snow. My ticket calls for going west on that line. I talk the matter over with the conductor, and he suggests that I go to the passenger agent of the Baltimore and Ohio as soon as we reach Chicago and try for reservations on the Santa Fe. I suppose a thousand other people have the same idea. I wonder now why I took this slow train to Chicago instead of the fast one.

I arrive in Chicago at 3:50 p.m. and the passenger agent tells me what I had already read in the papers, that all the trains west of Omaha on the Union Pacific are cancelled because of the severe blizzard. He makes some

January 1

About 10:30 p.m. I leave home again for a long trip.
I drop to sleep just before the train pulls out of
Washington at midnight.

January 2

Although I slept well, I cannot stay in bed and am
up for breakfast at 8:00 on a dreary, foggy morning. From
the Chicago papers I see that the trains are blocked in
the mountains to the west and I wonder whether I shall be
able to get through to San Francisco and make my plans to
Sydney. Later, the papers have stories that all the trains
on the Northwestern and Union Pacific are stranded in snow.
My ticket calls for going west on that line. I talk the
matter over with the conductor, and he suggests that I go
to the passenger agent of the Baltimore and Ohio as soon as
we reach Chicago and try for reservations on the Santa Fe.
I suppose a thousand other people have the same idea. I
wonder now why I took this slow train to Chicago instead of
the fast one.
I arrive in Chicago at 3:50 p.m. and the passenger
agent tells me what I had already read in the papers, that
all the trains west of Omaha on the Union Pacific are
cancelled because of the severe blizzard. He makes some

inquiries but has no luck with the Santa Fe. So I take a cab to the Chicago office of Pan American Airlines and they get me a place on the Trans World Airlines for tonight (really tomorrow, at 1:10 a.m.). It isn't possible to stay in Chicago because all hotel rooms are taken for a big furniture convention. I go over to the Palmer House, check my bags, and see a no-good movie. Then I check again with TWA and everything is said to be "routine" to leave the Palmer House at 12:10 a.m. I call home and settle down to wait. Thus does one day end and another begin.

January 6

I leave the Palmer House at 12:10 a.m. for the airport and check in at 12:50 with plenty of time for an early-morning cleanup.

It is very cold and windy as we get into the plane at 1:20. Likely it will warm up after we get on our way. We are in the air at 1:47. Here I go again on another long night flight -- this time over the snow drifts (I hope) that the trains cannot go through.

I doze a bit and dream. We are down at Kansas City between 3:40 and 4:21 a.m.

I get a few short naps before the sun comes up near the Nevada-California line. We come to the coast and do a

lot of circling before we are finally down at the San Francisco airport at 7:45 a.m. (PST). I go into the city air office of Pan American, where I check my flight to Sydney. Everything seems to be in order. They get me a room at the St. Francis Hotel, where I sleep for a while and then work on the Soil Survey Manual.

January 7

About 8:00 in the morning I leave the hotel and go to Berkeley by streetcar and train. I spend the day in the Soil Survey office at Berkeley, mostly dictating a draft of Chapter III of the UNESCO-FAO pamphlet on world food. In the evening I have dinner with Mr. and Mrs. Roberts. They drive me up on the heights for a view of the city and then to my hotel in San Francisco.

January 8

During the day I make some minor repairs to my luggage and make some last-minute additions to my wardrobe. About 9:30 p.m. I leave the hotel and go to the air station, where I check in and take the bus to the airport at 10:45. There is more checking in at the airport and I go to the plane at 11:20. It is cool outside and in the plane. The pilot

does a lot of testing at the end of the runway, which is a good idea considering the long hop to Honolulu. Here we go, in the air at 11:40 p.m. Soon we are over the moon-lit sea, and thus one day passes to another.

Soon the cloud cover is essentially continuous. Although the San Francisco newspapers quoted Pan American officials as saying that planes were routed near Mount Loa on Hawaii -- now in eruption -- this crew doesn't want to go that way, and likely won't. One crew member says, "We might be late," and that the plane has a bad weather report from Hilo, which, of course, would have nothing to do with Mount Loa.

About 5:30 (HST) it is somewhat rough, but clear. We fly lower below nearly continuous clouds, and above small, scattered, fleecy ones. The sea is moderate.

Hawaii is covered with clouds, but we see Maui in the distance. We are down at the Honolulu airport at 9:00 a.m. (HST).

I call both Dr. Aschler and Dr. Sauer. Dr. Aschler comes down at once and drives me hurriedly over the experiment station of the Pineapple Research Institute. I see some very interesting things. (1) breeding pineapples for resistance to grubs; (2) plowing by use of a power-driven coultter and belt on a large plow, which saves several months in time from the last raton crop of pineapples in

January 9

About 6:30 a.m. (HST), it begins to get light. We fly over fleecy, scattered clouds, with nothing to be seen on the patches of ocean. Now, for some breakfast. Soon the cloud cover is essentially continuous. Although the San Francisco newspapers quoted Pan American officials as saying that planes were routed near Mouna Loa on Hawaii -- now in eruption -- this crew doesn't want to go that way, and likely won't. One crew member says, "We might be late," and that the plane has a bad weather report from Hilo, which, of course, would have nothing to do with Mouna Loa.

About 8:30 (HST) it is somewhat rough, but clear. We fly lower below nearly continuous clouds, and above small, scattered, fleecy ones. The sea is moderate.

Hawaii is covered with clouds, but we see Maui in the distance. We are down at the Honolulu airport at 9:06 a.m. (HST).

I call both Dr. Auchter and Dr. Baver. Dr. Auchter comes down at once and drives me hurriedly over the experiment station of the Pineapple Research Institute. I see some very interesting things on: (1) breeding pineapples for resistance to grubs; (2) plowing by use of a power-driven coulter and belt on a large plow, which saves several months in time from the last ratoon crop of pineapples to

replanting; (3) preparation of land by chopping and the use of a rototiller, without plowing; (4) DD for nematode control; (5) the use of hormones, first to delay fruiting, and then, with another kind, to bring on fruiting as needed, to even the work load seasonally; and (6) high-clearance tractors, used to add fertilizers and chemicals for weed control.

The Station has a large collection of pineapple species, varieties, and new crosses.

The weather here in Honolulu is warm, humid, and rainy -- "Kona weather."

I have lunch at the Country Club with Dr. and Mrs. Auchter and Dr. and Mrs. Bayer. We review old times and personalities. As usual, there is much talk about the world food problem and the potentialities of tropical soils.

Dr. Bayer tells me that machines for harvesting heavy sugarcane are still not well perfected. He says that soils on some of the sugar plantations are now definitely declining in fertility. He feels certain that this is not a matter of nitrogen, phosphorus, and potassium, but is due to some other cause, possibly related to the physical condition of the soil, either directly, or indirectly through changes in the micro-population and organic matter.

Some of the plantations north of Hilo are on thin soils, and he thinks that erosion has been a factor in declining yields. But on some of these soils the cane is very much better following 4 or 5 years of grass than when it is grown continuously. In these areas, the rainfall is very high and soil tilth may be the important factor.

My hosts drive me back to the airport a little before 3:00 p.m. I go onto the plane, with the usual leis, and we are in the air at 3:36 p.m. (HST).

Soon we are over slight, fleecy clouds and a calm sea. Later the clouds thicken; it gets dark; and the day comes to an end.

January 10

At 1:35 a.m. (HST) we prepare to land at Canton Island. Even before we are down, it seems hot in the plane. We are on the ground at 12:45 (Canton Island ST). The people on duty at this little American station seem most unalert, indeed; perhaps more from the heat than from sleepiness. We have some light refreshments. It is too dark to see anything except the coarse coral sand near the station.

We are in the air out of Canton Island at 1:41, and soon cross the International Date Line and pass to January 11.



②

Fiji

January 11

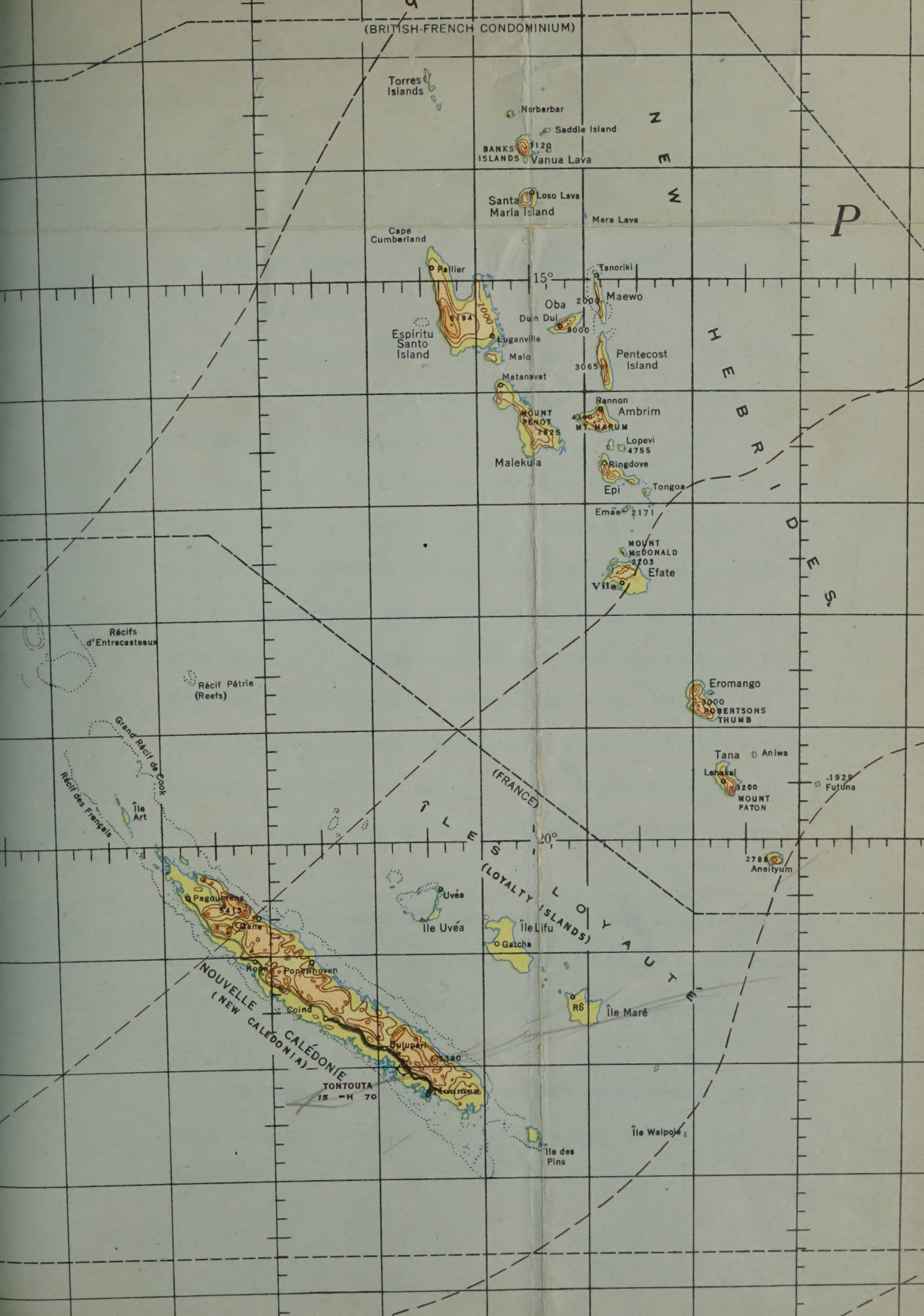
At 6:30 a.m. (FST), we are over an area of discontinuous coral reefs and barriers. The sea is calm. A few fleecy clouds float in a gentle headwind. Soon we get our first glimpse of the real islands. Probably not Vanua Levu yet. I try some kodachromes of beautiful farm land with sugarcane on Viti Levu.

We are down at the Nandi airport in the Fiji Islands at 7:11 a.m. (FST). Back of the airport, we walk through a pleasant flower garden to a place called Fiji "Mocambo" (= meeting place) for breakfast. I talk with one of the men in charge, who tells me that Lloyd Smythe is the soil chemist at Fiji. They tell me that the sugarcane is very good: They have yields of 35 tons per acre! I am told that there are two agricultural experiment stations, and that in the hilly land erosion is becoming a serious problem. After breakfast, the sun is bright and warm. It certainly feels good. It is a great pity to be always in such a hurry. I should like to loiter here a few days.

I am back in the plane at 8:20 a.m. for the next hop to the airport near Nouméa in New Caledonia. Just after we take off at 8:33, I get some pictures of the main island of Viti Levu and of some small islands just to the west.



K-1751 January 11, 1949
Fiji - western Viti Levu. The last upland and the
swamp of the coast flying west.



③ *New Caledonie*

Then, the hostess gives us a handful of forms to be filled out for the Australian officials, some in duplicate. These forms suggest that the Australians should prefer to have no visitors.

At 11:05 a.m. (NCST) we pass one of the Loyalty Islands, probably Île Maré. The land looks to be nearly barren.

It is very cloudy as we come over New Caledonia to land at Tontouta, the international airport for Nouméa. I try for some pictures through the clouds over the southern tip of the island. The soils are steep and red, probably from serpentine. Rough, jagged mountains lie to the north. Even the alluvial coastal strips look poor. Much of the land is bare. Perhaps one-third to one-half of it has thin woodland, and the rest seems to have rather short grass. There is a good deal of evidence of excess salts. I see practically no good farms.

We are down at 11:47 a.m. (NCST). This is a rather miserable air station, characteristic of some of the French at their worst. Everything is rather forlorn, run-down, and dry.

Near the station, I see some very poor, thin, grayish-brown soil on andesitic lava. The air is hazy and hot, about 34°C.



④ Sidney - Webster Graves

We are in the air for Sydney at 12:44. We fly first over a coastal terrace of brown, thin, woodland. We move our clocks back another hour, the last time before Sydney. We are served the first poor meal of the trip. Now I am really getting tired. How I should like to lie in a proper bed and sleep! There is nothing to see, just miles and miles and miles of the Coral Sea under a thin haze.

About 5:50 p.m. (SST), everyone gets up in a mad scramble for coats, hats, and so on, although we are not due to arrive until 6:00 and apparently shall be late. We come over the coast at Sydney about 6:10 p.m. The city seems to be built on a complex pattern of little bays, estuaries, and peninsulas. There must be quite a transportation problem.

We are down at the Sydney airport at 6:20 p.m. with a poor landing, but no harm done. After a few minutes in the plane, we are taken into a little room at the customs office. Apparently the staff here is small and extremely slow. We have a very long wait -- really a terrible one, considering how tired everyone is. When the staff does finally get around to me, they are most courteous indeed. I am met by Mr. R. Brewer from the CSIR (Council of Scientific and Industrial Research). I am through with the

customs at 7:40 p.m., and then find it necessary to hold a press conference (!) about the reasons for my visit and so on. I am simply too tired to go far with it.

Mr. Brewer takes me to the Wentworth Hotel, where a room has been reserved. The whole area is very wet from unusually heavy recent rains. (This left-hand driving is a little nerve-wracking!) It is too late for dinner, but I really don't mind. Brewer tells me I am to leave by air for Brisbane at 3:00 p.m. tomorrow. There is a lot to be done before then.

My back is really curled up after this trip, and I am in bed at 9:00. After a short wait, have my breakfast. To my amazement, the coffee is good. Immediately after breakfast, Mr. Golding, from the radio broadcasting studio, comes into the lobby of the hotel with a copy of the November issue of Successful Farming under his arm. He is a most persistent and stubborn man. So, first I go to the station and make a radio platter about the world food situation, but only a short one.

Then, Mr. Brewer and I go to the CSIR office and, in the same building, pick up my ticket for the afternoon journey to Brisbane. In order to arrange my passage to Auckland at the end of the month, I must get a permit to enter New Zealand from the government agents, even though I

January 12

I get up too early; can't help it. I sort out various maps and things to leave in the hotel and go down for breakfast at 6:45. I find there is nothing doing in the hotel until 8:00, and it is the maid I am to see about everything I want to leave or want to get done. She takes a suit for pressing and some laundry. Heaven knows when I will call for it again, and I book a room for January 30.

Item: I note from the morning paper that hereafter taxi drivers in Sydney will not be allowed to have either their undershirts or their braces showing!

I take a little walk around the block, and after a short wait, have my breakfast. To my amazement, the coffee is good. Immediately after breakfast, Mr. Goldsmythe, from the radio broadcasting studio, comes into the lobby of the hotel with a copy of the November issue of Successful Farming under his arm. He is a most persistent and stubborn man. So, first I go to the station and make a radio platter about the world food situation, but only a short one.

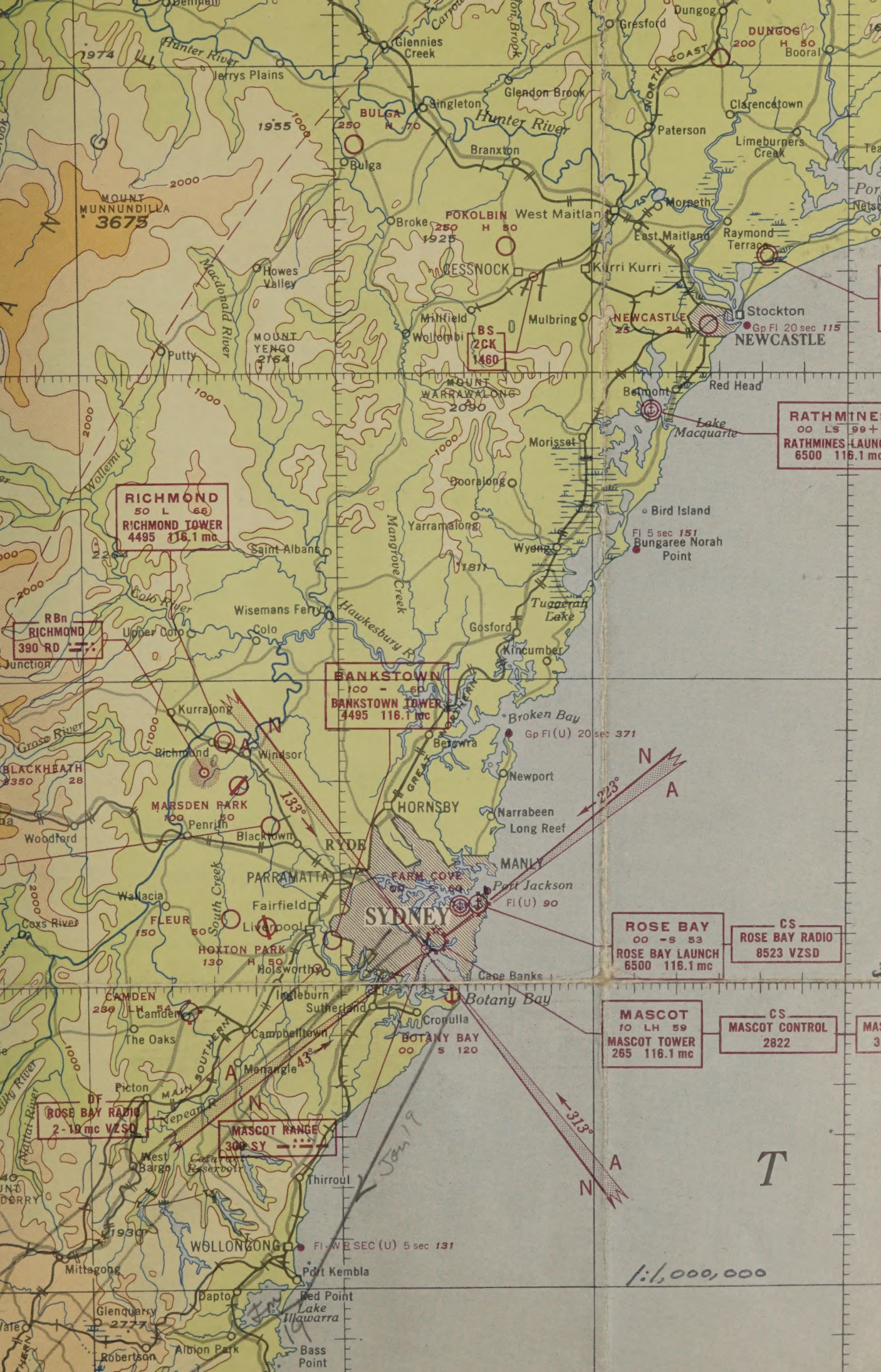
Then, Mr. Brewer and I go to the CSIR office and, in the same building, pick up my ticket for the afternoon journey to Brisbane. In order to arrange my passage to Auckland at the end of the month, I must get a permit to enter New Zealand from the government agents, even though I

have a proper passport and a visé. (The officials tell me that it is really not necessary for Americans, but they don't dare advertise that!!) Also, I must get a permit to leave Australia from the Australian tax office! While waiting for this certificate, I get some money from the bank, send a cable to Washington with my Brisbane address, and get the proper equipment from the local electric store to make it possible for me to use my American razor and my English transformer. This is some toggle when all together.

I take my tax-clearance paper to another booking office and fix up my ticket for January 31 to Auckland. There is a good deal of confusion over the exchange order I brought from Washington, but I hope it is all straightened out.

Then, I call briefly at the office of the American Consul-General, and Mr. Brewer takes me back to the airport. At 3:20 p.m., I am again in the air.

We go north over rugged, coastal country with thin woodland. It is sunny, but very hazy. Soon the cloud cover is nearly complete. Near Kempsey, on the Macleay River, I get brief glimpses of the country, which appears to be a sharply rolling plain, with some fields, but mostly



RATHMINES
00 LS 99+
RATHMINES LAUNCH
6500 116.1 mc

RICHMOND
50 L 66
RICHMOND TOWER
4495 116.1 mc

BANKSTOWN
100 - 60
BANKSTOWN TOWER
4495 116.1 mc

ROSE BAY
00 - S 53
ROSE BAY LAUNCH
6500 116.1 mc

CS
ROSE BAY RADIO
8523 VZSD

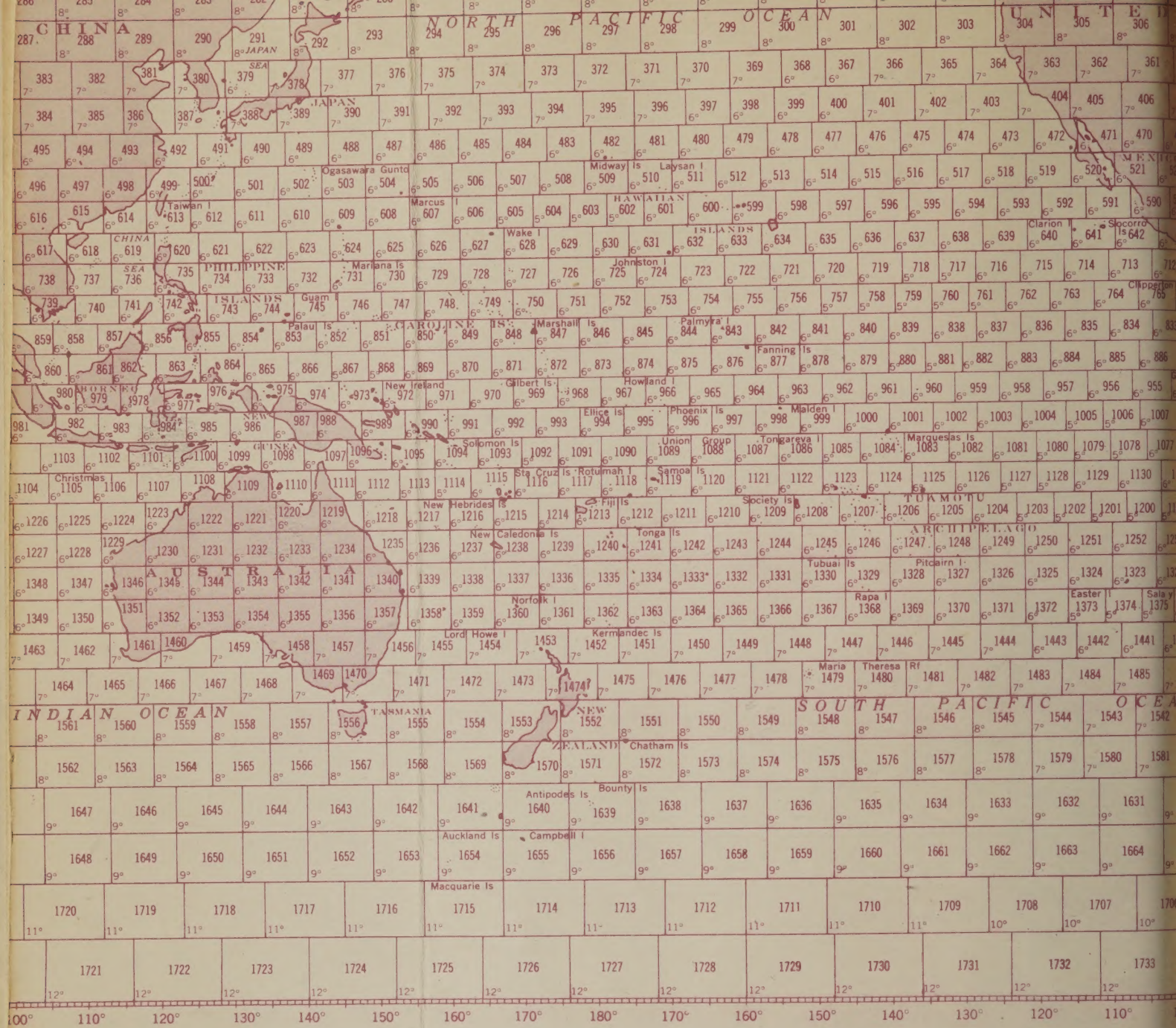
MASCOT
10 LH 59
MASCOT TOWER
265 116.1 mc

CS
MASCOT CONTROL
2822

ROSE BAY RADIO
2-10 mc VZSD

MASCOT RANGE
300 SY

1:1,000,000



WORLD AERONAUTICAL C

Scale of Series 1:1,000,000

BOLS

AERONAUTICAL SYM

RADIO FACILITIES

All frequencies are kilocycles unless otherwise stated. Use of the word R. HOMER within the box indicates "Voice facilities". RBN preceded by the

5 or SEAPLANE PORTS — LIMITED
ES Refueling services for normal traffic
repair facilities.

Radio Range
(With voice)

WOODY RADIO
291 AB —:::

Non-Direct
(Without voice)

LANDPLANE



Military



Civil



Joint Civil and Military

Radio Range
(Without voice)

WILLOW RANGE
320 KB ==:::

Radio Com
(With voice)

Radio Range
(Very high frequency with voice)

BELT RADIO
109.1 mc MT —=

Radio Con
(Without voice)

Radio Direction Finder
(With voice)

DF
MANUA HOMER
116.1 mc

Radio Bro

GES

Internatio

thin woodland. Some areas have a high percentage of grass. Although I cannot see well, I suspect that this is not very good farming country.

Beyond, we pass over areas that are more hilly and mostly covered with forest. Then, solid clouds.

There is just enough of a break so that I see Grafton on the Clarence River. The town is located on a terrace. The river is muddy and full, I suppose because of the recent rains. Near Rappville, the hilly parts are nearly all covered with thin forests, whereas the undulating and rolling areas are mostly cleared and used for grass. The land to the northwest is hilly and forested. Then, solid clouds again.

As we near Brisbane, I see an undulating plain with about one-third to two-thirds woodland. The soil seems to be reddish-brown in color. Brisbane is sprawled out and has plenty of room.

At 5:58 p.m., we are down at the Eagle Farm Airport, where I am met by Mr. G. D. Hubble of the CSIR, who drives me to Lennons Hotel. I have a very nice, air-conditioned room (but at 2/6/0 per day!).

After a light supper, I have a conference with the people here interested in my visit: Mr. G. D. Hubble, CSIR; Professor L. J. H. Teakle, Professor of Agriculture

at Queensland University; Professor W. H. Bryan, Professor of Geology at Queensland University; and Mr. W. G. Wells of the Queensland Department of Agriculture.^{1/} At this conference there are long talks about the alternative routes and the possibilities for changing the previous plan. It all ends with the plan exactly where the conference began. I go to bed very, very tired.

^{1/} In Australia, the advisory work is largely handled by the State Departments of Agriculture, as well as a good deal of the research. The CSIR carries on fundamental and applied research throughout the Commonwealth, but there is no strong Commonwealth Department of Agriculture comparable to that in the United States. Further, there is little formal cooperative work with the Universities in either research or advisory service. Of course, there is a good deal of informal cooperation because of the common interests of individuals.



SEA

DANGER
AREA

*Council Boundary
Yellow Polyadic
Red Polyadic with
dots*

*Sample No 1
Polyadic
Polyadic*

Redland Bay

People 2

*Relatively more culture
than shown.*

(Joins 1339-Water)

(Joins 1358)

(Joins 1357)

(Joins 1357)

AMBERLEY RANGE
395 AY

AMBERLEY
80 LH 79
AMBERLEY TOWER
4495 116.1 mc

HAMILTON REACH
00 -S 105
HAMILTON REACH-TOWER
6500

ARCHERFIELD
50 L 60
ARCHER TOWER
385 116.1 mc

CS-DF
ARCHERFIELD RADIO
3175 VZBN

RBN
ARCHERFIELD
385 BN

EAGLE FARM RANGE
275 EF

EAGLE FARM
20 LH
EAGLE TOWER
245 116.1 mc

EAGLE FARM
285 EF

RBN
AMBERLEY
390 AY

LOWOOD
250 LH 60

BS
4AK
1220

BS
4SB
1060

1:1,000,000

COOLANGATTA
18 27

220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 Statute Miles 390 400

CORRECTION INSTRUCTIONS

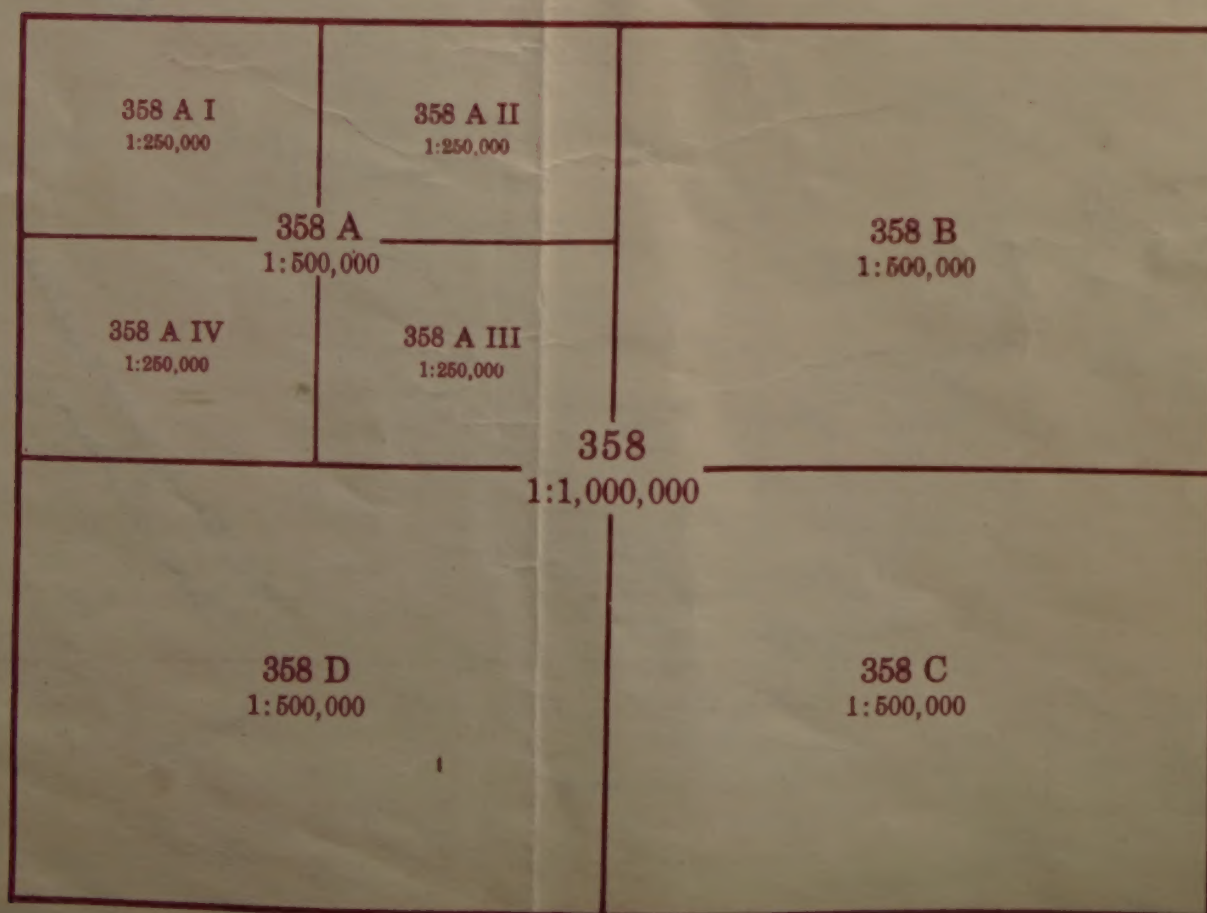
1. Military users of this chart are urged to mark hereon any errors or omissions. Corrections of radio and airway information, drainage, cultural features (roads, canals, power lines, etc.) should be marked on the face of the chart or overlay of the area. In reporting elevation corrections, state method used by observer in making the determination.

2. Every effort is being made to furnish the user with accurate charts. The user will materially assist in this effort by:

- Marking correction on face of chart or under remarks on back of chart.
- Fold chart along regular fold lines, but with back out.
- Make an extra fold along dotted line, and staple at points so marked.
- Drop in any U.S. mail box.

REMARKS: *© Brisbane*

INTERCHART RELATIONSHIP



AERONAUTICAL SYMBOLS

AIRCRAFT FACILITIES

AIRPORTS — COMPLETE FACILITIES Refueling services, complete repairs, shelter, and (where applicable) passenger or cargo services and/or seaplane ramp with hauling-out facilities.

AIRFIELDS or SEAPLANE PORTS — LIMITED FACILITIES Refueling services for normal and limited repair facilities.

SEAPLANE LANDPLANE

- | | | |
|--|--|-------------------------------|
| | | Military Base |
| | | Civil |
| | | Joint Civil and Military Base |

SEAPLANE LANDPLANE

- | | | |
|--|--|--------------------------|
| | | Military |
| | | Civil |
| | | Joint Civil and Military |

LANDING GROUNDS and ANCHORAGES

- Landing Strip — Very limited or no facilities
- Landing Area — Very limited or no facilities or information thereon not complete
- Sheltered Anchorage — Very limited or no facilities
- Emergency Anchorage — Very limited or no facilities or information thereon not complete

AIRFIELD DATA

- 300 Elevation in feet
- L Minimum lighting; obstruction, boundary or runway lights and lighted wind indicator
- H Hard surface runway, normally all-weather
- N Normally sheltered take-off area
- 60 Length of longest runway to nearest hundred feet

ASANSOL
300 LH 60

TARANTO
3 LH 60

When specific information pertaining to landing facility data is lacking, the respective character is replaced by a dash (-).

ASANSOL
300 -H 60

TARANTO
3 -H 60

AIR NAVIGATION LIGHTS

Numerals in italics indicate elevation above mean sea level.

- Rotating Light ———— 110 ★
- Rotating Light (With flashing code lights) ———— ★
- Rotating Light (With course lights) ———— 15 ★
- Flashing Light ———— ★

- Flashing Light (With code) ————
- Obstruction Light ————
- Marine Light (Elevations of marine lights are above high water.) ————
- Lightship ————

F—Fixed
Fl—Flashing

Occ—Occulting
Alt—Alternating

Gp—Group
R—Red

W—White
G—Green

B—Blue
(U)—Unwatched

SEC—Sector
sec—Second

Marine lights are white unless colors are indicated; alternating lights are red and white unless otherwise indicated.

MISCELLANEOUS

- Mooring Mast ————
- Dirigible Base ————
- Prominent Transmission Line ————
- Lighted Obstruction ————
- Obstruction (Numerals in italics indicate elevation above mean sea level.) ————

- Visual Ground Sign ————
- Town having Visual Ground Sign ————
- High Explosives Area (Marked) ————
- High Explosives Area (Unmarked) ————

January 13 *Most of the rain falls in December,*

Again I am up at 5:30, and very thankful for the tea and toast the maid brings at 6:00. I write letters to Drs. Grange and Archey in New Zealand, giving them my exact arrival time and flight number. This promises to be a good day, except for a slight kink in my side. Before breakfast, I take the tram up to the City Post Office and send a cable to Washington with my addresses until January 20, and back to the hotel for breakfast at 8:00. The streets and trams are crowded, so I guess that many people can arrange to get their breakfast before 8:00. Of course, not many of them are staying at this hotel at 2/6/0 a day.

I am ready to leave at 9:00, and go out with those that met me last evening, together with Mr. L. G. Vallance from the Queensland Department of Agriculture, a young man from the CSIR, and a driver. We go out southeast of Brisbane on undulating, old land. It is a complex of metamorphics from marine sediments. *usual times of city workers.*

About 8 miles out is a thin eucalyptus woodland with pasture. From road cuts, I judge the soil to be some sort of podzolized yellowish-brown soil with strong, bright yellowish-brown B horizons and sandy, grayish-yellow A horizons. Apparent rock is mostly shale. The rainfall is

about 45 inches. Most of the rain falls in December, January, and February. This soil is said to extend far north, even into places with 100 inches of rainfall.

Offhand, I should call these smooth, planosolic Red-Yellow Podzolic soils. This is poor agricultural country, and the associated bottom lands and alluvials are also poor. These lowlands have heavy clay soils and paper-bark eucalyptus. The trees are poor and in thin stands. I see a few apiaries, with the bees working on the flowers of the eucalyptus. Most of the soils are on uplands. The higher areas and upper slopes have brown soil, with grayer soil on the lower slopes.

At about 13 miles out, near Capalaba, we stop to look at the soil (said not to be really typical of anything). The cover is thin woodland, with coarse, unidentified grasses beneath. I am told that these lands have brush fires every other year. Only a few places near the road seem to be cleared for rural homes of city workers.

I look at the soil hurriedly on a smooth upland with a slope of about 1 to 2 percent. It might be regarded as a subtropical Brown Forest, but it seems rather too acid. Likely it is transitional between the Brown Forest and the so-called "coastal podsols."



K-1619 January 13, 1949
Australia. Queensland. 13 miles southeast of Brisbane.
Suburban home on poor soil from basalt -- perhaps very
poor Brown Forest.



K-1620 January 13, 1949
Australia. Queensland. Near Wellington Station,
southeast of Brisbane. Pineapples and bananas on
"red loam" (a Red Latosol from basalt).

A ₁	0-5"	Very dark red silty clay loam. Firm, but porous and easily friable to granular. pH 5.3 ^{1/}
A ₃	5-12"	Dark reddish-brown plastic clay; some mottling with reddish-yellow. A few iron concretions.
B ₃	12-24"	Dark reddish-brown clay, highly mottled with reddish-yellow and reddish-brown, mixed with partially decomposed rock.
D	24" +	Grayish decomposed basalt.

This soil is not much good for farming. Certainly it is a poor Brown Forest (and not expected by my guides).

Apparently things would have been much simpler to start the day for everyone, if I had not asked to stop at this last place. I see several more rural residences like the one photographed at the last stop.

About 15 miles out, near a stream on very old alluvium, I see what is said to be a good example of Prescott's ^{1*}/
coastal podsol.^{2/}

1/ Truog field kit.

2/ This is said to be similar to a local soil described by Mitchell as Virginia, and similar to another called Glasshouse sand in some of the literature. Geologists say that this soil has been formed during the past 4,000 years. It is now under a thin eucalyptus forest. (See Pamphlet No. 46. A Soil Survey of the Beerburrum, Glasshouse Mountains, and Beerwah Pineapple Districts. L. G. Vallance. Queensland Agr. Jour. June 1938.

Very dark red silty clay loam. Firm, but porous and easily friable to granular. pH 5.3	0-2"	A ₁
Dark reddish-brown plastic clay; some mottling with reddish-yellow. A few iron concretions.	2-12"	A ₂
Dark reddish-brown clay, highly mottled with reddish-yellow and reddish-brown, mixed with partially decomposed rock.	12-31"	B ₃
Grayish decomposed basalt.	31" +	D

This soil is not much good for farming. Certainly
it is a poor Brown Forest (and not expected by my guides).
Apparently things would have been much simpler to state
the day for everyone, if I had not asked to stop at this
last place. I see several more rural residences like the
one photographed at the last stop.
About 15 miles out, near a stream on very old alluvium,
I see what is said to be a good example of Prescott's
coastal podzol.

1/ Two field kits.
2/ This is said to be similar to a local soil described
by Mitchell as Virginia, and similar to another called
Glasshouse sand in some of the literature. Geologists
say that this soil has been formed during the past 1,000
years. It is now under a thin encyclopaedia forest. (See
Pamphlet No. 145. A Soil Survey of the Beaufort
Glasshouse Mountains, and Beaufort Pineapple Plantations.
J. G. Wallace. Queensland Agr. Jour. June 1938.)

Soil sample No. 1

- A₁ & A₀ Essentially absent. There is extremely little organic matter on or in the surface.
- A₂ 0-13" Nearly white, loamy fine sand; massive in place, but easily friable to crumb. There are many small reddish-brown concretions about 1/8 inch to 1 inch in diameter, especially in the lower part. (5YR 8/1 - white) 1/
- B₁ 13-23" Brown clay, with small subangular to angular nut structure. (5YR 5/3 - reddish-brown)
- B₃ 23-36" Mottled gray and reddish-brown heavy clay. Firm, and coarsely blocky. (Approx. 10YR 6/3 - pale brown, mottled with shades of red and reddish-brown)
- Most of the roots stop in the B₃. They are heavily concentrated at the contact between A₂ and B₁.

In frost-free areas, this soil is used for pineapples. Certainly, I should not want to call it a Podzol. In our system, it would probably be regarded as some combination of Planosol and Red-Yellow Podzolic.

We drive on east and see some productive undulating soils from basalt. I see a little maize about 6 inches high, tall Lady-finger bananas, vegetables, grapes, some

1/ Color designations in parentheses are those of air-dry collected samples filed at Beltsville.

tall maize, and pineapples. There is quite a bit of about pasture on the imperfectly drained lowlands. The cows in the pasture are not in very good flesh, but still is quite good for the subtropics. The vegetable growers have windbreaks of cane and use overhead irrigation, peas, with water from wells about 80 to 90 feet into the basalt.

As we come into the Wellington Point Station, I am told that we are on the "red loams" of Prescott. Professor Teakle regards the soil as a "red laterite, imperfectly formed from basalt." I should regard it as a Red Latosol from basalt. It is a productive soil. Yields of tomatoes run about 3,000 cases of 26 lbs. each per acre. Sugarcane runs about 25 to 30 tons per acre in 12 months, equivalent to 3.5 tons of sugar.

At Wellington Point, I look at a deep cut in this soil, and take a photograph to show the characteristic reticulate mottling of the lateritic material in the lower part. This material resembles laterite in all respects, except that it is only slightly hardened after exposure -- not stone-like.

The question arises as to whether this laterite is a differentiating requirement of the overlying soil. My guides dispute among themselves. I think not.

Good farms on this soil are said to be held at about \$1,000 per acre. Lady-finger bananas are grown and a good many pineapples. Even though frost-free, there is almost no citrus. There are some strawberries and many tomatoes, along with cabbage, cauliflower, beans, and peas. Only a few vegetables are seen now in the summer season. Most of the little fields are in fallow or cover crop. Here, maize is sometimes grown in the summer as a green manure crop before winter vegetables. Oats are also used.

Nematodes are often a problem, but they are not found generally.

We enter Cleveland -- a small, spread-out village with some poor Royal palms along the sidewalks and a few cows in the street. Beyond, we stop to look at a profile of this red soil. The land has been cleared and is nearly level -- say 1 percent slope. The cover is mostly Bermuda grass.

Soil sample No. 2

A ₁₁	0-1"	Like A ₁₂ , but slightly darker and mulch-like. (10R 3/3 - dusky red)
A ₁₂	1-7"	Dusky red (10R 3/2), friable, granular clay loam. Many grass roots bind the aggregates. (10R 3/4 - dusky red)
A ₃	7-13"	Dusky red (10R 3/4), friable, granular clay loam. More firm than the above. (10R 3/6 - dark red)

- B₁₁ 13-25" Dark red (10R 3/6) clay. Firm to dig, but easily friable to fairly soft granular. (10R 4/6 to 3/6 - red to dark red)
- B₁₂ 25-35" Like the above. (10R 4/6 - red)
- B₂ 35" + Dark red (10R 3/6) concretionary clay loam or clay. Firm in place, but easily friable when removed. (10R 4/8 - red)
- C_c Several feet (This was examined further down the slope in a deeper place.) Heavy clay, mottled with various shades of red; firm in place; and digs out in angular large blocks. (10R 6/6 - light red: mottled with pink)

The soil is underlain with basalt. This seems to me to be too red for Reddish-Brown Latosol. I should probably include it as a Red Latosol from basalt, although the physical properties are similar to the Reddish-Brown Latosols. Locally the soil is said to be a "red laterite" or a "red loam."

We go on south and are soon off the basalt onto the "coastal podsol" like Sample No. 1. Then we are back on the Red Latosol. The contrast is simply enormous. The area generally is a complex, along here, of these two soil groups.

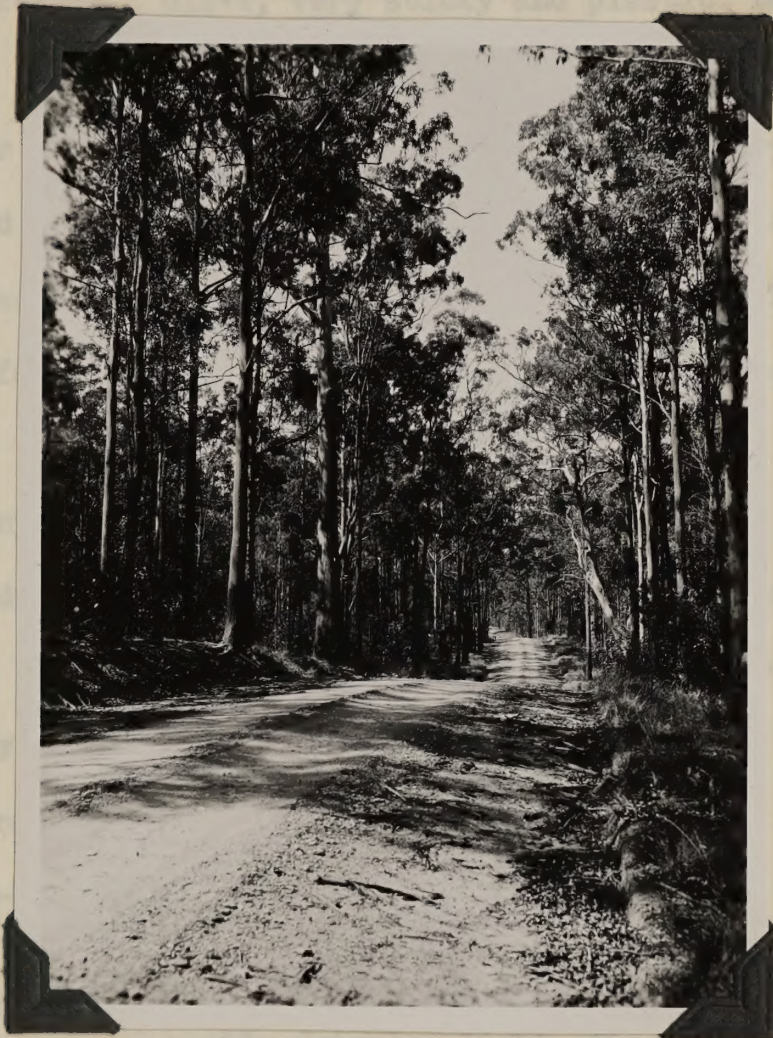
We stop for lunch at Redland Bay. I am told that through sugarcane breeding work in Queensland it has been

possible to increase the sugar content greatly without increasing the total tonage of dry matter, thus improving the efficiency of the plant nutrients and of labor.

After lunch, we drive generally west and are soon out of the red soil onto the poor "coastal podsol." Some of it is undulating and some rolling to strongly rolling. Most of it has a thin stand of eucalyptus and the surface burns every other year. I see a few patches of pineapples, bananas, and pasture on it. Near Mt. Caton, I photograph a typical eucalyptus forest on this soil -- E. propinqua or gray gum. Possibly the area photographed is a bit more dense than usual. The soil is rather thin over graywacke and shales interbedded. In places, beds of quartzite outcrop and the soil is said to be better! In this eucalyptus woodland, I see a few gray termite mounds about 3 feet in diameter and 3 feet high, roughly conical.

Near Kuraby, the "costal podsols" are on Tertiary rocks and water is available for irrigation. I see some mangoes and a good deal of pasture, with a bit of grain sorghum used as a soiling crop.

We stop in a flat area of imperfectly drained dark-colored soil from impure basalt. At first, my guides tell me that some regard this as Chernozem! I should regard it as a good example of Wiesenboden.



K-1621 January 13, 1949
 Australia. Queensland. Near Mt. Catan,
 southeast of Brisbane. Typical mature
 eucalyptus forest (E. propinqua = gray gum)
 on the "coastal podsol."

- | | | |
|----------------|---------------|---|
| A ₁ | 0-12"
(20) | Dark olive-gray clay (5Y 3/2). Hard medium blocky aggregates are held together by grass roots. (pH 6.3) |
| A ₃ | 12-24"+ | Olive, <u>very</u> sticky and plastic, moist clay, mottled with white. (pH 8.0) |

The water table is at 20 inches. In a local survey, this is called Archerfield clay. It closely resembles some of the black soils south of Algeria in North Africa. The soil is used for pasture and some of it is used for sweet-pea seeds.

Near Sunnybank, I look at a soil called locally Sunnybank sandy loam. It is on gently undulating to gently rolling table land about 200 feet above sea level. The land was originally forested and is now used for orchards, vegetables, and flowers. I should be inclined to call it latosolic Red-Yellow Podzolic soil.

- | | | |
|----------------|--------|--|
| A _p | 0-7" | Yellowish-brown, porous, brittle, easily friable, light, fine sandy loam. There are many insect holes. |
| A ₂ | 7-16" | Reddish-yellow, firm, easily friable, fine sandy loam. |
| B ₁ | 16-31" | Reddish-yellow, mottled with red, sandy clay loam. Massive, but fairly easily friable. |
| B ₂ | 31-42" | Red (10R 5/8) sandy clay, mottled with reddish-yellow. Massive and hard to dig, but easily friable when removed. |

B ₃	42-50"	Transitional, with red concretions.
C _c	50-72"+	Mottled red (minor) and reddish-yellow heavy mass of concretionary gravel. Individual pieces are 1/8-inch to 3/4-inch in diameter.

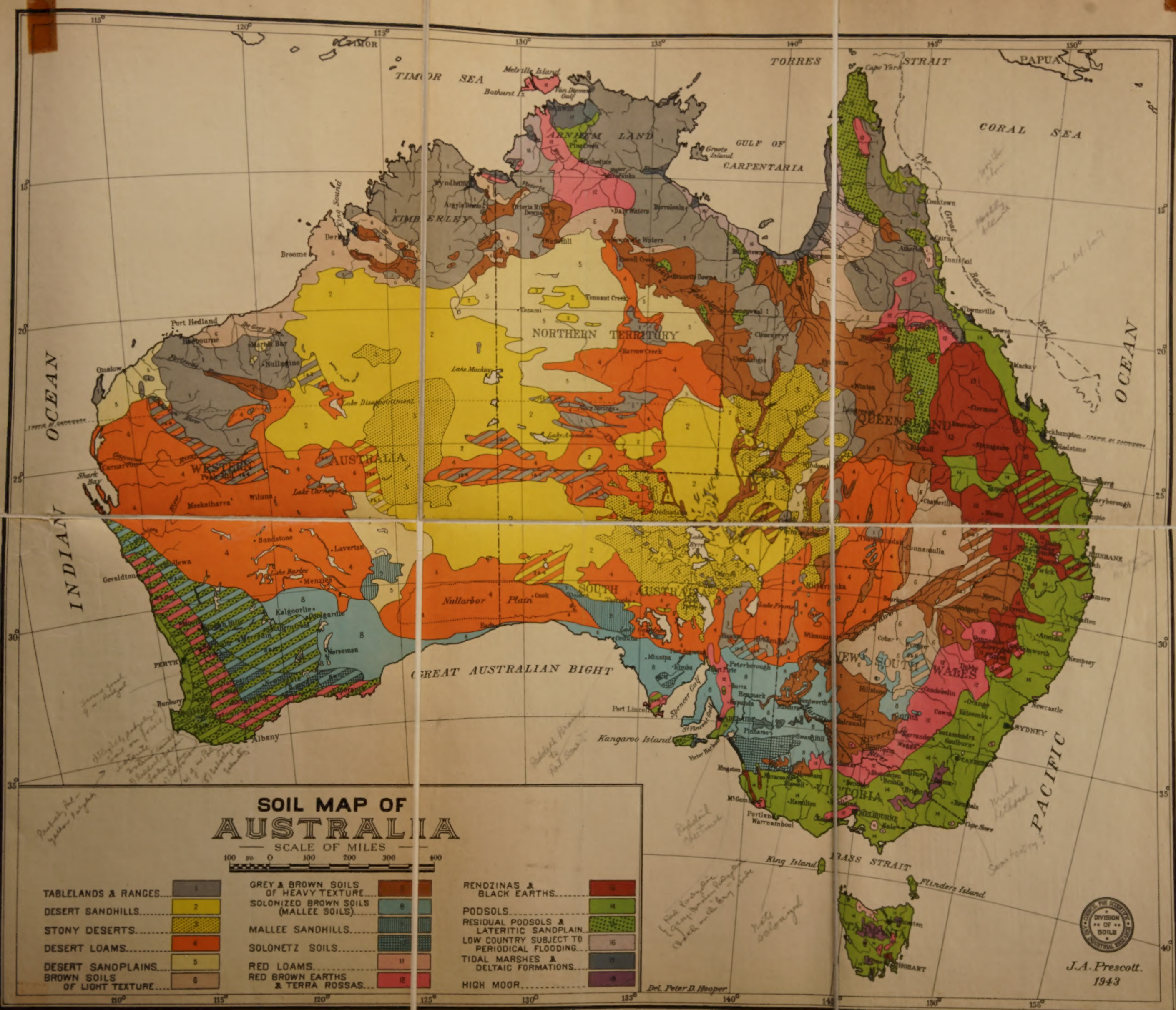
This soil reminds one a bit of the Tifton of southern Georgia. There may not be a definite genetic relationship between the C_c and the solum. Likely the concretions are now deteriorating and the soil may be moving toward a Reddish-Yellow Latosol (if there is such a thing!).

On this same plateau, I see a railroad cut in similar soil, but it is nearly all red with a few nearly uniformly distributed concretions. Although better drained, this soil is little, if any, higher in productivity than the previous one.

We drive west and south. I see some more areas of Wiesenboden, which is said to occur only on basalt here in the Brisbane area. We stop to see one near Archerfield and then go back to Brisbane. I get my papers and go to the airport to make bookings for Cairns and for Melbourne and Adelaide.

This has been a good day, and I am back in the hotel at 6:00 p.m. Since my back is no worse, it must be better.

All day there has been discussion about "red loam," "red laterite," and so on. I take part in only a little

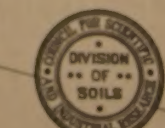


SOIL MAP OF AUSTRALIA

SCALE OF MILES
100 200 300 400

TABLELANDS & RANGES.....	1	GREY & BROWN SOILS OF HEAVY TEXTURE.....	7
DESERT SANDHILLS.....	2	OLONIZED BROWN SOILS (MALLEE SOILS).....	8
STONY DESERTS.....	3	MALLEE SANDHILLS.....	9
DESERT LOAMS.....	4	OLONETZ SOILS.....	10
DESERT SANDPLAINS.....	5	RED LOAMS.....	11
BROWN SOILS OF LIGHT TEXTURE.....	6	RED BROWN EARTHS & TERRA ROSSAS.....	12

RENZINAS & BLACK EARTHS.....	13
PODSOLS.....	14
RESIDUAL PODSOLS & LATERITIC SANDPLAIN.....	15
LOW COUNTRY SUBJECT TO PERIODICAL FLOODING.....	16
TIDAL MARSHES & DELTAIC FORMATIONS.....	17
HIGH MOOR.....	18



J.A. Prescott.
1943

COMMONWEALTH



OF AUSTRALIA

Council for Scientific and Industrial Research

BULLETIN No. 177

A Soil Map of Australia

By

J. A. PRESCOTT, D.Sc.

Reprinted 1947

MELBOURNE, 1944

Registered at the General Post Office, Melbourne, for transmission by post as a periodical.

COMMONWEALTH



OF AUSTRALIA

Council for Scientific and Industrial Research

BULLETIN No. 177

A Soil Map of Australia

By

J. A. PRESCOTT, D.Sc.

Reprinted 1947

MELBOURNE, 1944

Registered at the General Post Office, Melbourne, for transmission by post as a periodical.

A Soil Map of Australia*

INTRODUCTION

The assessment of the natural resources of Australia is a prerequisite of any intelligent planning of the use of these resources. The use of the land of Australia depends primarily on the two factors: soil and climate—these between them determine the native vegetation, which is the basis of pastoral occupation or forest management and the choice of crop, trees, or pastures which may be grown. The period of exploitation of the best soils in the best rainfall regions is rapidly drawing to a close, and increasing use must be made in the future of soils which are deficient in one or more respects, providing the rainfall is adequate and these deficiencies can be overcome. Where water conservation is possible and irrigation practicable, the water must be used on appropriate soils where there is a reasonable chance of irrigation husbandry being maintained on a permanent basis.

Since the Division of Soils of the Council for Scientific and Industrial Research was founded in 1929, considerable attention has been given therefore to the survey of soils under irrigation or intended for irrigation, particularly in the valleys of the Murray and Murrumbidgee Rivers. Elsewhere attention has been mainly directed to the study of deficient soils in regions of assured rainfall, and more recently still to the study of good soils in both pastoral and agricultural regions that have become subject to or threatened by losses due to erosion by wind and water.

In addition to this detailed work following the standard procedures of soil survey, an effort has been made to collect and interpret all the information available concerning the soils of Australia, taking the broadest possible point of view. Such information was first presented as a tentative soil map in 1930 and again in 1931. In 1941 a map of tropical Australia was published revising very materially the information previously presented.

In 1939 C. G. Stephens (1941) compiled a new soil map of Tasmania as a result of several years' close observation of the soils of that State.

The map now presented on a scale of 1 to 10,000,000 is the result of a reinterpretation of data previously considered and of many new personal observations made in the course of traverses made for this purpose in many parts of Australia. The interpretation owes much to the work of my colleagues at the Waite Institute, to Dr. L. J. H. Teakle (1938) in Western Australia and to the interpretations of Western Queensland by Mr. S. T. Blake (1938) and Dr. F. W. Whitehouse (1940, 1941). The explorations of Mr. Michael Terry, Dr. C. T. Madigan, and the anthropological expeditions of the University of Adelaide have provided much new information with respect to boundaries and have been productive of many useful soil samples from the arid interior. Professor J. B. Cleland has made available the logs of numerous traverses noting the types of vegetation in these regions. The work of the Mackay Aerial Survey Expeditions of 1930, 1933, 1935,

* Typescript received January 7, 1944.

and 1937 (Bennett 1935, Mackay 1938) has provided new information concerning the boundaries of the sandhill country in the western deserts.

The surveys of the Division of Soils within their special fields have made possible accurate interpretations with respect to distribution and description of the major soil groups.

In the compilation of the vegetation and soil maps of Bulletin 52 (Prescott, 1931) of the Council for Scientific and Industrial Research, much use was made of the records of exploration and of official surveys. In compiling the new map all the information has been replotted from the official journals, and in the case of the interior of South Australia the original records of land survey and classification have been consulted.

It is not the purpose of the present bulletin to do more than explain the map. The fuller discussion of the soil zones and their climatic, geological, and vegetational relationships must be left for a more extended study. The principles outlined in Bulletin 52 have, however, been found to maintain their usefulness in interpreting the nature of the soils, and this publication should be consulted for these principles. The value of the study of the morphology of the soil profile, due originally to the Russian school of workers, has been abundantly confirmed both in the broader exploration and in the formal and detailed soil surveys.

In Bulletin 52 emphasis was placed on the leaching factor in determining the process of soil formation. Exploration of tropical and desert Australia has revealed the necessity for the consideration in addition of the "normal" erosion factor—a factor which has been emphasized notably by E. F. Gautier in his studies of the Sahara (1928) and of French West Africa (1935). It will be seen from the legend of the map that eighteen soil groups or formations are now recognized. The soils of major true soil groups are the result of an equilibrium between the leaching factor of the climate and the parent material from which the mature soil profile is developed.

Another group may be related to the desert formations. In these soils the leaching processes are at a minimum. Further, owing to the sparseness of the vegetation on land of any degree of slope, soil erosion is a characteristic sequel to heavy rainstorms, resulting in bare rocky ranges or tablelands. The products of weathering, which would in other circumstances have remained to form soil, are deposited as broad alluvial plains. In the tropical monsoonal regions a similar set of circumstances is associated with the commencement of the summer rains after the long period of winter drought. The soil material washed from the ranges is deposited eventually in the broad deltas and tidal marshes of the tropical rivers. This feature is further accentuated by the high tidal range in the estuaries of the rivers of the north and north-west.

The influence of parent material is to be recognized in three soil groups, the terra rossas, the red loams, and the rendzinas. The red loams are derived from highly ferruginous material, frequently of basaltic origin, and are thus buffered against the process of podsolization. From observations in New Zealand, rainfalls of the order of

200 inches per annum are required to induce podsolization in such material. The terra rossas and rendzinas are both derived from highly calcareous materials; the terra rossas occur mainly on hard limestones while the rendzinas are black soils derived from marls or soft limestones. These calcareous parent materials also buffer the soils against podsolization, and in the zones of the podsols and red-brown earths such soils have many of the characteristics of the black earths.

In the final construction of the map, an attempt has been made to secure uniformity of presentation over the whole geographical range of the continent. For some areas much more detail is available than for others. In some cases the detail is on too elaborate a scale for presentation other than by a system of alternate banding. In others the detail has been left out for the sake of uniformity. The wide belts of calcareous sands characteristic of certain coastal regions represent probably the most serious of such omissions.

THE MAJOR SOIL ZONES OF AUSTRALIA

In all, eighteen soil formations or zones have been recognized. In the following enumeration they are given the same numbers as on the map, and an attempt is made at some general classification.

A. *Stony and Rocky Areas Relatively Free From Soil.*

1. Tablelands and ranges of the desert and tropical regions.

B. *Desert Formations.*

2. Desert sandhills.
3. Stony deserts.
4. Desert loams.
5. Desert sandplains.

C. *Zonal Soils with Parent Materials in Equilibrium with the Leaching Factor.*

6. Brown soils of light texture.
7. Grey and brown soils of heavy texture.
8. Solonized brown soils (mallee soils).
9. Mallee sandhills.
10. Solonetz soils.
11. Red loams.
12. Red-brown earths and terra rossas.
13. Rendzinas and black earths.
14. Podsols.
18. High moor.

D. *Low Level Tropical Formations.*

16. Low country subject to periodical flooding.
17. Tidal marshes and deltaic formations.

E. *Soil Residuals.*

15. Residual podsols and lateritic sandplain.

1. Tablelands and Ranges

In the tropical regions subject to marked seasonal drought and in the desert regions, the erosion factor plays a very important part on areas with any degree of slope or which are at such a level above the drainage system of the country as to permit of the rapid dispersal of run-off water. This factor has been noted for tropical West Africa by Gautier (1935) and in tropical Australia by Voisey (1939). Both in desert and tropical regions at the end of a long dry spell with intense heat, the vegetative cover is insufficient to prevent erosion during periods of torrential rainfall immediately following the break of the drought.

Under these conditions, two types of country may be recognized in Australia—steep sided ranges, and tablelands associated with either horizontally bedded rocks or with cappings of laterite. The soil material so eroded away is deposited as broad alluvial plains in the desert and semi-desert regions or in the deltas and marsh regions of the tropical coasts. The most important of such denuded areas include the Nullagine, Hamersley, and Ashburton country of Western Australia, the Kimberley region of Western Australia between the King Leopold Range and the Carr Boyd Range with an extension towards the Victoria River country of the Northern Territory, the eastern section of Arnhem Land with an extension into Queensland as far as Cloncurry, and the mining country of north Queensland including the eastern half of Cape York Peninsula and an area south-west of the Atherton Tableland. In the desert regions, the Devonport, Macdonnell, Musgrave, Warburton, Barrier, and northern Flinders Ranges are important. There are many tablelands in the western parts of Queensland. These tablelands and ranges have so far proved to be of little or no pastoral or agricultural value. Here and there amongst the ranges there occur small valleys of some potential future value, but their extent, number, and distribution are not known. The first step in the evaluation of the potential land use of tropical Australia would be the exploration of the areas in order to separate with some degree of detail and accuracy the ranges and the true soils.

2. Desert Sandhills

The sandhill country of the Australian deserts occurs in the three main localities. The so-called Great Sandy Desert, named by Warburton, south of the Kimberley region of Western Australia; the Victoria Desert, named by Giles, north of the Nullarbor Plain; and the Arunta or Simpson Desert, in the south-east corner of the Northern Territory and the adjacent parts of Queensland and South Australia. A smaller area occurs between Tennant Creek and Tanami, in the Northern Territory. These sandhills are all vegetated with spinifex (*Triodia*) as the characteristic grass. The Australian desert sandhill country is essentially one of parallel sand ridges with alternating flats, and its general features have been described by Madigan (1936). The distance apart, height, and direction of the ridges varies in different parts of Australia. The trend in the western deserts is in general east and west. In the eastern desert area the trend is somewhat to the west of north.

3. Stony Deserts

The three important areas of stony deserts are the Gibson Desert in Western Australia named by Giles, the South Australian areas to the west of Lake Eyre, and the stony deserts usually associated with the name of Sturt in south-western Queensland. The original "Sturt's Stony Desert" actually lies in the area between the Diamantina River and the Cooper Creek in the north-east corner of South Australia.

These stony deserts are of three main types. The Gibson Desert consists of rolling plains of ironstone gravel and is obviously part of the great laterite peneplain which covers so much of the higher levels of Western Australia. The South Australian and Queensland occurrences are characterised by "gibbers", fragments of the siliceous duricrust characteristic of many of the desert tablelands. The relationship between the stony deserts and the tablelands is such that South Australian surveyors and pastoralists refer to the stony deserts as tableland country. Some of the Queensland tablelands have lateritic rather than siliceous cappings. A third type of stony cover is less specialized in character, it consists of quartz or even of broken country-rock when the denudation of the ranges has proceeded almost to base level.

These stony deserts owe their permanence to the protective action of the stones and gravels following the erosion of loose sand and soil by wind and water. In the Gibson Desert the soils to a depth of 20 to 30 inches have been found to contain as much as 70 per cent. of ironstone gravel associated with sandy loams. From the vegetation point of view the Gibson Desert appears to be a spinifex desert.

The soils associated with gibber country are usually quite heavy in texture. The vegetation may include desert scrub dominated by mulga (*Acacia aneura*), but in South Australia towards the Queensland border and in Queensland, Mitchell grasses (*Astrebla* spp.) become increasingly important.

4. Desert Loams

This is perhaps the least satisfactory of the subdivision of the desert and semi-desert regions in so far as it includes a wide range of formations dominated in the main by mulga and other acacias. The soils also include the calcareous loams associated with the shrub steppes of saltbush (*Atriplex* spp.) and bluebush (*Kochia* spp.) and the saline, shallow calcareous soils of the Nullarbor Plain. The western formations differ from the eastern ones in the presence of laminated cemented horizons, a feature characteristic of much of the goldfield country of Western Australia. This character has been described and the boundaries of the area defined by Teakle (1936). These cemented horizons suggest a process of accumulation rather than denudation and are probably associated with extensive level areas receiving the run-off from the tablelands and ranges. The cementing material appears to be siliceous.

A practicable subdivision would probably be along the following lines when further detailed geographical knowledge is available:—

- (a) Soils with cemented horizons.
- (b) Soils without cemented horizons.
- (c) Soils derived from calcareous parent materials.

5. Desert Sandplains

The most important of these areas are in the Northern Territory in the country centred at Tanami with a smaller area between the country of Tennant Creek and Barkly Tableland. Although these areas are relatively accessible, they have proved impossible of pastoral occupation even for cattle owing to their general lack of fertility and the absence of edible grasses and shrubs. The Tanami region is undoubtedly one of soil residuals, since ironstone gravels are characteristic and the soils are acid. The area is a high-level peneplain characterized by a vegetation association which includes *Triodia* as the dominant grass, with acacias, mallee, eucalypts, and hakeas.

The area of desert sandplain to the south-east of Tennant Creek is one of the least known areas in Australia. Outliers of it on the Barkly Tableland have been recognized as having affinities with the podsollic residuals of Queensland.

6. Brown Soils of Light Texture

Two major textural subdivisions may be recognized in soils. These are the light textured sands and the heavier textured loams and clays. The division is sufficiently important in determining both the character of the native vegetation and the behaviour of these soils towards rainfall penetration for it to be found practicable to separate the important group of brown soils of the semi-arid regions into these two subdivisions. The brown soils of light texture are characteristic of much of the country of the De Grey River in Western Australia, in Teakle's Warralong province. They are associated with the Pindan country to the east of Broome and Derby in the west Kimberley region, the light country in the vicinity of Daly Waters, and the country between the north-west "downs" of Queensland and the Croydon mining areas. In southern Queensland and north-western New South Wales these are the lighter textured soils between the western slopes of the Dividing Range and the more arid country of the interior. These light textured brown soils have surface horizons which are usually somewhat acid in reaction (pH 5.8—6.8) and show little evidence of the differentiation of subsoil horizons of heavier texture. In the tropical regions no evidence of calcium carbonate in the profile has been found to depths of 36 inches, but there is evidence that the southern members of the group in the semi-arid regions of Queensland and New South Wales have calcareous subsoils.

The vegetation carried by these soils is generally a low tree savannah. The soils occur in the region of predominantly summer rainfall, although this is not the factor which divides them from the mallee soils which continue the succession of light textured brown soils in south-western New South Wales.

7. Grey and Brown Soils of Heavy Texture

These soils form the most important pastoral soils in the semi-arid regions of Australia. They are members of Marbut's great group of *Pedocals*, that is they are characterized by the presence of calcium carbonate in the lower horizons. They are related to the Russian group of Sierozems or grey soils in which the characteristic presence of gypsum in the lower horizons is typical. In a characteristic profile

of these soils the surface few inches will have a nutty or crumb structure with a cloddy subsoil. Calcium carbonate may be present as small concretions or flecks from the surface or subsoil horizons down. In the deeper illuvial horizons gypsum is often present. In colour the whole profile is usually uniformly grey or brown.

In Australia these soils occur in a great arc starting in the Wimmera of Victoria and forming the bulk of the plain soils of the Riverina, the western Darling Downs, the Rolling Downs of north-western Queensland, the Barkly Tableland and the Victoria River Downs in the Northern Territory, and the heavier alluvial soils of the Ord and Fitzroy Rivers in the Kimberleys. They are characterized by an open grassland, frequently treeless. In the northern areas Mitchell (*Astrebla* spp.) and Flinders (*Iseilema* spp.) grasses are dominant. In the south they come within the zone of saline influence which is characteristic of the mallee soils. The treeless plains of the Riverina and the Murray River flats may also be saline and are associated with such shrubby plants as cotton bush and bluebush (*Kochia* spp.) and dillon bush (*Nitraria Schoberi*).

These soils also extend into the more arid regions as the so-called "channel country" of the inland rivers. These alluvial plains are flooded only occasionally and the occasional flood waters behave as would an increased rainfall in determining the character of the soils. The Roy Hill country on the Fortescue River in Western Australia, the plain of the Sturt Creek south of the Ord River, and the braided channels of the plains of the rivers of western Queensland are included. Along the Darling and Murray these plains extend as far as Lake Bonney in South Australia, and many characteristic soils have been described in the soil survey reports dealing with the irrigated areas along the River Murray.

Until recent years, agriculture on these soils has been practised only in the Tatiara district of South Australia and the adjoining Wimmera district of Victoria. Under irrigation in New South Wales many of these soils have proved useful for rice growing and, on the more fertile types, for pasture production.

8. Solonized Brown Soils.

The word solonized is derived from the Russian word "solonetz" which is used to describe the soil in section 10. The process of solonization may be described as the replacement under natural conditions of part of the replaceable calcium in the soil by sodium through reaction with common salt ultimately derived in most cases in southern Australia from the cyclic salt brought in from the Southern Ocean on the wind and in the rain. The zone of brown soils in southern Australia is characterized by the presence of salts in the soil approximating in composition to those of the sea and probably reaching a maximum concentration in the soils of the Nullarbor Plain. In the eastern wheat belt of Western Australia, such concentrations of salt reach economic importance in reducing soil fertility for arable husbandry. In the irrigation areas of the Murray Valley these salt concentrations are equally important.

These soils have little or no solonization. They are permanent saline, but not solonized.

Solonized clays are more readily dispersed than the original clay of the soil, and in consequence the clay is readily washed downwards through the soil with the consequent formation of illuvial horizons, although the rainfall may not be particularly heavy.

The soils carry a characteristic scrub of mallee eucalypts on the lighter textured members, and the heavier soils in Western Australia are associated with a sclerophyll woodland in which the salmon gum (*Eucalyptus salmonophloia*) is the most characteristic dominant.

In South Australia and Victoria the topography associated with these soils takes the form of parallel sandridges with an east-west trend separated by flats of heavier texture. Calcium carbonate is present in varying amounts and may constitute in some cases a substantial proportion of the parent material. The topography results in the association of the soil types into well recognized catenas.

Many soil series in this group have been described in the soil survey reports of the Council for Scientific and Industrial Research dealing with the irrigated settlements along the River Murray in Victoria, New South Wales, and South Australia. A general description of the mallee soils of South Australia has been given by Prescott and Piper (1932). The Western Australian group is described by Teakle and his associates (1939, 1940).

9. Mallee Sandhills

Where the parent material of the mallee soils is arenaceous and of sufficiently great extent, there occur large masses of sandhill country in which the characteristic trend of parallel ridges may be absent. Such country has been described as "jumble" in Victoria. The characteristic vegetation is an association of dwarf eucalypts with *Triodia* (mallee with spinifex).

In some localities in South Australia bordering this sandhill country, agriculture has been attempted but considerable trouble has been experienced with sand drift. In general, however, no attempt is made to develop this type of country for agricultural purposes. Extensive units of this type of country occur to the north-west and north-east of the Nullarbor Plain in what are essentially semi-desert areas.

10. Solonetz Soils

The original solonetz soils were described from Russia, where the characteristics were recognized by Gedroiz (1912) as being due to the effect of the replacement of the reactive calcium in the soil by sodium as a result of chemical exchange in the presence of naturally occurring salt solutions. The name is in fact derived from the Russian word for salt. The most characteristic feature of these soils is the development of a heavy clay subsoil with a columnar structure underneath a grey sandy surface. The most closely related normal soil in Russia is the chernozem or black earth. In Australia such related soils occur probably also in the black earth belt of Queensland, particularly amongst those which carry a vegetation association including brigalow (*Acacia harpophylla*), but no field work has been done in this direction. On the climatically wetter side of the

mallee soils, however, such solonized soils showing the characteristic subsoil structure are very common, and an excellent example from Western Australia has been described by Burvill and Teakle (1938).

An early Australian description of what is probably a solonetz is by Mullett and Scott (1923) of a soil at Goroke in Victoria. The *Mankoorra sand* described by Taylor (1933) has all the chemical and field characteristics of a solonetz.

11. Red Loams

Red loams are deep soils showing little or no evidence of differentiation into horizons in the profile. The red loams of Australia are relatively restricted but they are sufficiently characteristic and of sufficient economic importance to be separated from the other red soils. They are generally derived from basaltic parent materials in which the process of weathering of the silicates has resulted in the formation of free iron oxide and kaolinite.

The soils owe their character essentially to the presence of these iron oxides. Some of the red loams are derived from ferruginous deposits, others have been recognized by Bryan (1939) as red-earth residuals associated with older land surfaces. The majority derived from basalt have a high level of fertility but have also high fixing powers for phosphates. The most important localities are the Atherton Tableland in north Queensland, certain localities in Victoria, the north-west of Tasmania, the Darling Downs in Queensland, and the Dorrigo Tableland, the Camboyne district, and other areas in New South Wales.

Some of these soils have been described by Prescott and Hosking (1936), Stephens (1937), and Parbery (1939).

12. Red-brown Earths and Terra Rossas

Red-brown earths are soils with a characteristic development of horizons with the accumulation of clay and the presence of calcium carbonate in the illuvial horizons. The leaching is not sufficiently active, however, to mobilize the iron oxide of the soil independently of the clay. The presence of free calcium carbonate is not invariable, particularly if the parent materials are deficient in lime.

The soils occur in the zones of seasonal rainfall, whether of the Mediterranean type with the rain in winter or the tropical type with the rain in summer. At the height of the wet season, however, conditions are such that leaching is effective for a limited period. It is suggested that the relative stability of the iron oxides of these soils is due in part to the effect of the annual drying out of the soil associated with the season of drought. The most important occurrences of the soils are in the wheat belts of Western Australia, South Australia, and New South Wales. In the tropics the main occurrences appear to be in the neighbourhood of Charters Towers, Queensland, and south of Darwin in the Northern Territory. The chemical and physical characteristics of the red-brown earths of South Australia have been described by Piper (1938).

The terra rossas are soils which have been recognized in the Mediterranean region and which are characteristically derived from hard limestone. The processes which direct the formation from limestones of red soils and of black soils in the same regions are at present obscure. Terra rossas have been recognized by Stephens and his associates (1941) in the south-east of South Australia.

13. Rendzinas and Black Earths

Soils bearing affinities with the black earths of Russia and North America on the one hand and with the Regur of India on the other are to be found in the eastern part of Australia between Burdekin River of Queensland in the north and the Liverpool Plains of New South Wales in the south.

No detailed soil survey work has been done on any of the black earths of Australia and only some broad scale reconnaissance work in the Callide Valley by the Cotton Branch of the Queensland Department of Agriculture. Geographically, the black earth region of Australia is restricted to a broad ecotone with a relatively uniform distribution of rainfall efficiency throughout the year. Parent materials are frequently basaltic or consist of carboniferous limestone. The presence of calcium carbonate in the lower horizons of the soil profile is an important characteristic of these soils.

The rendzinas are black soils derived from calcareous marls and the name is of Polish peasant origin. In Poland the name, which is of doubtful meaning, is given to soils derived from calcareous or gypseous parent materials and may be derived from a Polish word meaning "to tremble" indicative of the sounds heard when cultivating. The soils are black in colour and remain well supplied with lime even under reasonably wet conditions. Rendzinas may be recognized on limestones in many parts of Australia.

14. Podsoles

The name podsol is a Russian word of peasant origin which has become recognized internationally as descriptive of an important group of soils associated with hard-leaved forests in the wetter parts of the world. Literally the word means "just like ashes" and refers to the ashy grey sub-surface eluvial horizon which immediately overlies the yellowish grey clay subsoil of the characteristic podsol. In Australia the soils are associated with the wetter climates and with eucalyptus forests, heaths, and sclerophyll scrubs. In transitional areas podsoles develop most readily on sandy parent materials. Variants that have been recognized include those with red or yellow subsoils and those with humus hardpans. In the less humid regions the type tends to a transitional form which is usually called a podsollic soil with a grey-brown or brown surface horizon. In the true podsol, iron oxide is leached from the surface horizons. The podsoles are important in the eastern coastal regions, the south-west and south-east of the continent, and in Tasmania. The podsolized soils are represented on the tablelands of New South Wales and in much of Victoria.

15. Residual Podsoles and Lateritic Sandplain

It was suggested in Bulletin 52 that the many occurrences of laterite in Australia should be related to a previous humid cycle and that the massive and pisolitic ironstones technically known as laterite could best be regarded as residual illuvial horizons of soils formed during such a cycle. The sandplains of Western Australia were also regarded as being survivals of former podsollic soils. The concept of the "fossil" nature of these soils as parent materials for new soils has received increasing acceptance, and corresponding types have been recognized, notably in Queensland by Whitehouse (1940) and Bryan (1939). The pattern of soils which are being formed currently and those which show evidence of survival from a past geological age is very complex in Western Australia, and until detailed field work is done over the whole south-west of that State an exact mapping will not be possible. In parts of the solonized brown soil zone there is a triple complex of brown soils, solonetz soils, and lateritic sandplain.

Extensive occurrences of such soils are also found in Queensland. In the traverses inland from Townsville these occurrences were usually noted by the author as "inland podsoles" until the work of Whitehouse further south confirmed their lateritic character. It is probable that the soil of much of the area described as desert sandplain in the Northern Territory should be classed as a podsollic residual.

16. Low Country Subject to Periodical Flooding

It has been pointed out earlier that a necessary outcome of erosion under tropical seasonal rainfall is a deposition of the eroded material at the lower levels. Round the shores of the Gulf of Carpentaria and in the western parts of Arnhem Land large areas of low level country merging into the deltaic formations of the tropical rivers appear to be characteristic. It is possible that the annual flooding results in a degree of podsolization, but the areas are relatively inaccessible and need further study.

17. Tidal Marshes and Deltaic Formations

These are essentially of the same origin as the group of soils in the previous section but represents the heavier textured soils subject to long periods of flood or tidal influence. In some cases, as at the mouth of the McArthur River near Boorooloola in the Northern Territory and between the Ord and Victoria Rivers astride the boundary between Western Australia and the Northern Territory, the coastline is quite indeterminate and deep fringes of mangrove swamps line the coast. Much of the southern and eastern shore of the Gulf of Carpentaria is of this character. Near Darwin the deltaic sections of the Adelaide and Alligator Rivers are somewhat better known. On the Queensland coast the tidal marshes at St. Lawrence and the delta country of the Burdekin are relatively well known. Part of the latter is used for irrigation.

18. High Moor

The group of soils known as high moors are well known in the cooler regions of the world. They occur where the evaporation and temperature are sufficiently low to maintain the soil wet over long

periods of time and to reduce the rate of decomposition of plant remains. They are characterized by a peaty surface overlying clays on a shallow water-logged soil. In Australia the high moors are represented by the high country of the Australian Alps, the "High Plains" of Victoria, and the plateaux of Tasmania.

ACKNOWLEDGMENTS

The construction of the map would not have been possible but for the interest, help, and companionship in the bush of many people whom it is impossible to mention individually. In the early years of the work the Surveyors-General of the several States made available a great deal of information. Those who have supplied maps, soil samples, or other information include Mr. Michael Terry, Dr. C. T. Madigan, Mr. K. M. Durack, and Mr. G. W. Leeper. All my colleagues in the Soils Division and particularly Mr. C. G. Stephens and Mr. R. L. Crocker have helped in the collection of soil samples and the discussion of pedological and ecological principles. In the final stages of the map, much constructive criticism was received from Dr. L. J. H. Teakle and Mr. G. H. Burvill of Perth, Dr. W. H. Bryan of Brisbane, and Dr. N. H. Parbery of Sydney. To Mr. P. D. Hooper I am indebted for the cartography and for the search through the records of the Lands Department of South Australia.

REFERENCES

- Bennett, H. T. (1935).—*Aust. Geographer* 2(8): 3.
 Blake, S. T. (1938).—*Proc. Roy. Soc. Qld.* 49: 154.
 Bryan, W. H. (1939).—*Proc. Roy. Soc. Qld.* 50: 21.
 Burvill, G. H., and Teakle, L. J. H. (1938).—*J. Agric. W. Aust.* 15: 97.
 Gautier, E. F. (1928).—"Le Sahara". (Paris.)
 ——— (1935).—"L'Afrique Noire Occidentale". (Paris.)
 Gedroiz, K. K. (1912).—*Zhur. Opyt. Agron.* 13: 363.
 Mackay (1938).—Mackay Aerial Reconnaissance Survey Expedition, 1930, 1933, 1935, and 1937. Map. (Sydney.)
 Madigan, C. T. (1936).—*Geogr. Rev.* 26: 205.
 Mullett, H. A., and Scott, P. R. (1923).—*J. Dept. Agric. Vict.* 21: 583.
 Parbery, N. H. (1939).—N.S.W. Dept. Agric. Regional Soil Series Nos. 1 and 2.
 Piper, C. S. (1938).—*Trans. Roy. Soc. S. Aust.* 62: 53.
 Prescott, J. A. (1930).—*J. Coun. Sci. Ind. Res. (Aust.)* 3: 123.
 ——— (1931).—*Coun. Sci. Ind. Res. (Aust.)*, Bull. 52.
 Prescott, J. A., and Piper, C. S. (1932).—*Ibid.* 56: 118.
 Prescott, J. A., and Skewes, H. R. (1941).—*Ibid.* 65: 123.
 Stephens, C. G. (1937).—*Coun. Sci. Ind. Res. (Aust.)*, Bull. 108.
 ——— (1941).—*Coun. Sci. Ind. Res. (Aust.)*, Bull. 139.
 Stephens, C. G., Crocker, R. L., Butler, B. E., and Smith, R. (1941).—*Coun. Sci. Ind. Res. (Aust.)*, Bull. 142.

- Taylor, J. K. (1933).—Coun. Sci. Ind. Res. (Aust.), Bull. 76.
- Teakle, L. J. H. (1936).—*J. Dept. Agric. W. Aust.* 13: 480.
- (1938).—*J. Roy. Soc. W. Aust.* 24: 123.
- (1939).—*J. Dept. Agric. W. Aust.* 16: 202.
- Teakle, L. J. H., Southern, B. L., and Stokes, S. J. (1940).—*J. Dept. Agric. W. Aust.* 17: 251.
- Voisey, A. H. (1939).—*J. Proc. Roy. Soc. N.S.W.* 72: 136.
- Whitehouse, F. W. (1940).—Univ. Qld. Papers. Dept. Geol. 2 (N.S.) No. 1.
- (1941).—*Proc. Roy. Soc. Qld.* 53: 1.

Font 8

The "Pond" along the coast over
saw "cater all". The area in seen
cater in using: Plover, Larks, Larks
Red & green Larks, Plover, and Red
Larks.

of it because of the need to concentrate on these notes. Certainly "coastal podsol" and "red loam" are poor terms. One grants that an enormous number of kinds of soil are included in the area shown on Prescott's map as "podsol." First of all, a great deal of the area, perhaps the largest part of it, is lithosolic.^{2*} Part of it, we should certainly want to call Planosol in the United States, perhaps something like Putnam moved south and leached more. Mr. Despite the noisy party in the next room, I optimistically go to bed at 9:00 p.m. in charge of plant nutrition. I

get my tickets fixed, and we leave for the field about 6:00 a.m. on a road west toward Ipswich. By 10 miles, we are in rather poor, rolling country. Some of the small country places have patches of fields and gardens, with poultry. But most of this "coastal podsol" is covered with thin eucalyptus forest. The ground is largely sandstones and shales of old Tertiary beds. The surface soil is light brown. The heavy horizons are brown or yellowish-brown.

At 11 miles, we pass over some partly level and imperfectly drained land, and some undulating land with a rather poor pasture.

At about 12 miles, we leave the Ipswich valley floor to the south. The land is rolling again. The soil is

January 14

Again the light and the noisy elevator awaken me at 5:30, but my spirits are lifted with tea at 6:00. I check over my air tickets and find them wrong, so that job shall need to be done over again.

Because of the wool auctions here, breakfast is earlier -- at 7:30 -- and I am in the lobby ready to go by 8:00. My companions come at 8:15 and include Mr. C. R. von Stieglitz of the Queensland Department of Agriculture, who is in charge of plant nutrition. I get my tickets fixed, and we leave for the field about 8:40 a.m. on a road west toward Ipswich. By 10 miles, we are in rather poor, rolling country. Some of the small country places have patches of fruits and gardens, with poultry. But most of this "coastal podsol" is covered with thin eucalyptus forest. The rocks are largely sandstones and shales of old Triassic lakes. The surface soil is light brown. The heavy B horizons are brown or yellowish-brown.

At 13 miles, we pass over some nearly level and imperfectly drained land, and some undulating land with a rather poor pasture.

At about 14 miles, we cross the Brisbane city limits to Goodna. The land is rolling again. The soils are

browner and more productive, especially on the old high terraces of the Brisbane River. Pastures are fair, but the soils are podzolized much like Sample No. 1. Most of the houses along here are built very high, likely for good aeration in the hot weather.

At 17 miles, we pass Redbank Station. There is some erosion on the upper, strong slopes, but not much. There is an intricate pattern of local soil types and phases according to color, content of gravel, and depth to the B horizon.

As we come to Bunvamba, I see dark brown soil on basalt. It is gently undulating to rolling and developed from early Tertiary formations. The soil appears to be more productive, especially on the lower slopes and in the depressions.

Between Bunvamba and Ipswich are railway shops and trading centers, now a little run-down. In the center of Ipswich, we pass from the basalts to the sandstones and shales of Triassic times. The soils are poor. West of the city, we drive through undulating to rolling "coastal podsols" with thin eucalyptus woodland. The soils are thin, gravelly, and even stony on the hilltops.

Five miles west of Ipswich, we pass over a small area of gently rolling soil from Tertiary basalt. One small hill

has red soil -- perhaps a relic of a former landscape and climate. These red soils are said to be found on other ridges too.

At $7\frac{1}{2}$ miles, we are again off basalt and onto "coastal podsols" from calcareous shales of Jurassic times. The soils are only fair, but better than Sample No. 1. The A horizons are thinner and the B horizons thicker. Part of the land is in forest and part is in pasture. It is rolling or undulating. I see a few brown termite mounds about 3 to 4 feet across at the base and 2 to 3 feet high.

A mile further on, we come into relatively open, undulating country. Most of it is in pasture, which looks quite good, along with some maize, millet, and several fields of sown grass, perhaps sudan. I see no perennial legumes. The surrounding hills are said to be capped with basalt.

At 12 miles from Ipswich, and within view of the Marburg Mountains, I look at a brown soil that certainly couldn't be any kind of a Podzol. The slope is about 4 percent. The geologists think that the parent material is primarily calcareous shale. Likely the soil was developed under thin woodland or park forest. The soil looks much like Brown Forest that has been hit a bit with the Rendzina club.



K-1622 January 14, 1949
Australia. Queensland. 12 miles west of Ipswich.
View toward Marburg Mts. on Marburg soils, intermediate between Brown Forest and Rendzina. Mostly pasture with some maize, millet, and sudan grass.



K-1623 January 14, 1949
Australia. Queensland. 12 miles west of Ipswich.
Typical farm house.

- A₁-p 0-10" (Perhaps thicker on the lower slopes.) Very dark gray clay, mottled with black and reddish-brown. Medium angular nut structure, with suggestion of prismatic. Some small well-rounded, nearly black concretions. Many roots. Soil is friable with difficulty. (pH 7.0)
- A₃(G) 10-20" Light olive-gray clay, mottled with pale yellow and nearly black. Many dark red to nearly black irregular concretions about 1/16 to 1/3 inch in diameter. Plastic, sticky, and massive. (pH 8.0)
- C 20-30"+ Like the above, but slightly lighter in color.

We drive west and pass Minden on a terrace of brown soil of uncertain character. I see poona peas, maize, and pasture. Beyond are strongly rolling brown soils from sandstone and calcareous shale. Here there is some erosion, with small gullies and slips. At 18 $\frac{1}{2}$ miles west of Ipswich, we come to a high hill and look west a long way. It is said that one may see Brown Forest soils on the well-drained lowlands, black soils in the depressions, and "coastal podsols" on the hills. As we cross the valley, the termite mounds are quite numerous in the thin woodland pasture on the "coastal podsols." (See photograph near Gatton.)

We pass a small, but good, area of nearly level brown soil. It may be Brown Forest, but we now must hurry to reach Gatton by 11:00 a.m. For what reason, I don't know.



K-1754 January 14, 1949
 Australia. Queensland. 12 miles west of Ipswich. View looking toward Marburg Mts. on Marburg soils, intermediate between Brown Forest and Rendzina. Mostly pasture, some maize, millet, and sudan grass.



K-1755 January 14, 1949
 Australia. Queensland. CSIR Station near Gatton. View on black soil of the self-mulching sort. (Site of sample #3)
 Prof. Bryan with back to camera speaks to Mr. Hubble.

There is quite a mixture of local soil types here. Some are brown, productive, and nearly level. On these I see maize, not too good, in all sizes from 6 inches to 5 feet, along with sudan grass and millet, but no perennial legumes. Most of the work in the field here is done with horses.

Eight miles east of Gatton, we come onto a large, old, alluvial flood plain, with dark-colored soils. Geologists estimate that there has been no flood in the past 4,000 years. There is good ground water for irrigation at 50 feet. Pumpkins, maize, onions, and lucerne (alfalfa) are grown, and now there is a lot of fallow. Onions are harvested in September. All the lucerne I see is very short, but I am told that farmers get 8 cuts per year. All the irrigation is over-head. We stop near Gatton at the Queensland State Agricultural High School and College (Lawes). We call briefly here at the CSIR Station. Rainfall is 28 inches. The Station is now emphasizing linseed (seed flax) planted in April and May and harvested in November or December.

After a few moments, we go out onto the flat to look at the soil. The lowest areas in this plain have very dark soils, somewhat resembling Wiesenboden in color. The soil here is locally called "black earth." Although it looks

something like the Fargo clay (a chernozemic Wiesenboden), it probably belongs with the self-mulching clays of the tropics. Where I look at the soil, the slope is about zero, in an area that was the settling basin in the old alluvial plain.

Sample No. 3

- A_p 0-6" Very dark gray to black (2.5Y 3/0) clay, with coarse angular blocks showing some vertical breakage. The soil is very hard. It now has some brown roots. When dry, the soil seems to be dark gray to very dark gray and becomes somewhat more granular. When moist, the soil is quite easily friable for one so rich in clay. (pH 6.5 - 7.0) (2.5Y 2/0 to 3/0 - very dark gray to black)
- B₂ 6-34" Black clay, massive when moist, and when dry has sharp, angular blocky structure that is harder than the soil above. It is friable with difficulty when moist, and not at all when dry. Sample was taken between 17 and 18 inches. (pH 8.0) (2.5Y 2/0 to 3/0 - very dark gray to black)
- B₃ 34-46" Transitional. Very dark grayish-brown to nearly black, mottled with some white concretions. Massive. (pH 8.3) (7.5YR 4/2 to 5/2 - brown, with some fine light gray mottling)
- C 46-53"+ Dark yellowish-brown (10YR 4/4), massive, compact, sandy loam to sandy clay loam. Fairly friable when removed. Some slight mottling and streaking with very dark gray. (pH 8.2) (Approx. 5YR 4/3 - reddish brown)

The surface of the soil becomes coarsely granular when dry. Apparently the material in the lower part settled out of moving water, and that in the upper part, out of ponded water. I am told that many of the old ponded areas show zinc deficiencies. It is said that this soil is similar to those on the rolling "downs" from basalt. But this hardly seems possible. There is said to be about 10,000 acres of this black soil in the valley.

We leave the Station and drive to Toowoomba. It is a great pity I must always be in a hurry. Beyond Helidon are brown, undulating soils from old stream terraces -- perhaps better varieties of the "coastal podsols." Most of the land is fair woodland pasture, with some open pasture, hay, and maize. Some local soil types on the old alluvium look to me to be better than others. Certainly detailed surveys will greatly reduce the total area of "coastal podsols." There simply hasn't been enough opportunity here for combined detailed morphology and detailed mapping. Perhaps there is a bit too much worrying about theory and not quite enough about how to get the detailed field studies going. We go over several hills of sandstones as we approach the highlands west of us. Only the terraces are much used for crops. I see some shallow gully-erosion in cultivated fields, especially on sloping "coastal podsols."

The surface of the soil becomes coarsely granular when dry. Apparently the material in the lower part settled out of moving water, and that in the upper part, out of ponded water. I am told that many of the old ponded areas show zinc deficiencies. It is said that this soil is similar to those on the rolling "downs" from basalt. But this hardly seems possible. There is said to be about 10,000 acres of this black soil in the valley. We leave the Station and drive to Toowoomba. It is a great pity I must always be in a hurry. Beyond Helidon are brown, undulating soils from old stream terraces -- perhaps better varieties of the "coastal podsol." Most of the land is fair woodland pasture, with some open pasture, hay, and maize. Some local soil types on the old alluvium look to me to be better than others. Certainly detailed surveys will greatly reduce the total area of "coastal podsol." There simply hasn't been enough opportunity here for combined detailed morphology and detailed mapping. Perhaps there is a bit too much worrying about theory and not quite enough about how to get the detailed field studies going. We go over several hills of sandstones as we approach the highlands west of us. Only the terraces are much used for crops. I see some shallow gully-erosion in cultivated fields, especially on sloping "coastal podsol."

I have seen a good many ornamental palms today, but no palm crops.

About 20 miles beyond Gatton, we come into a hilly, forested area, the headwaters of Gatton Creek, which extends up to the dissected edge of the tableland of basalt. The hills are a mixture of basalt and sandstone.

As we break over the top onto the tableland, we are 2,000 feet above sea level and at Toowoomba. The soil is very red and called locally "basaltic red loam."

We have lunch here, and then several delays while people discuss the best way to hurry!! We leave to go west on the main road in the direction of Dalby. I see some nice gardens that make one think of North Africa, say the country around Algiers. We go by some nice-looking farms on this productive red soil. These are mostly dairy farms, with some wheat, oats, maize, and lucerne.

At 5 miles, we drop about 150 feet down, to basalt with dark brown to black surface soils. Here there is more wheat. I see some fallow for later sowing of small grain to be used as pasture. There is not much grass, and most of the dairy fodder is grown as crops. The country here is quite open, with only very thin woodland on the non-arable land.

About 8 miles west of Toowoomba, we stop to look at a "shallow black earth" or "black basaltic loam." This soil originally had some forest, but is now in developed pasture or crops. Slopes are gentle.

A _{p-1}	0-8"	Reddish-black (10R 2/1) heavy clay loam or clay. Mixed granular and rounded nut that is fairly easily friable. Many roots. The very surface is softly granular.
A ₃₁	8-16"	Dark reddish-brown clay loam. In place, the dark reddish-brown material is on the surface of the aggregates. When crushed, these have a reddish-yellow streak. The soil has a fairly easily friable, angular, coarse, blocky structure.
A ₃₂	16-24"	Like the above, but more mottled, lighter in color, and coarser blocks; merges into rotten basalt.
C	24-48"	Mottled yellow, gray, and red rotten basalt.
D	48" +	Dark grayish-brown basalt.

This is a very difficult soil to name. Likely it is some kind of subtropical Brown Forest tending toward a lithosolic Chernozem. In some places the solum is deep. On the strong slopes, I see some serious erosion. There is a considerable drought hazard. Wheat and grain sorghum are the principal crops. In smooth areas, where the solum is deeper, the soil is said to be highly productive.



K-1624 January 14, 1949
Australia. Queensland. 13 miles east of Gatton. Typical second-growth eucalyptus poor pasture land on "coastal podsol." Note termite mounds.



K-1625 January 14, 1949
Australia. Queensland. 8 miles west of Oakey. View on soil called "black earth," but not so hard or cracked as the tropical self-mulching clays. Trees were ring-barked.

We go on west, and about 2 miles beyond Oakey, we look at a red soil on a large, nearly level plain. Unfortunately, there is no excavation or cut, and I see only samples removed with a big soil auger.

A₁ 0-8" Reddish-brown, heavy, fine sandy loam.

B₂ 8-25" Dark reddish-brown clay. Hard, angular nut structure, with shiny coatings around the aggregates. Many grass roots.

B₃ 25-30"? Reddish-brown clay, more friable than the soil above, and with some flecks of lime.

C 36" + Reddish-brown, friable clay, tending toward yellowish-brown. A few black concretions.

Some of my guides say this soil is called locally "red earth," while others regard it as a "red-brown earth."

If I were pressed for an immediate name, I should call it a Reddish Chestnut or a planosolic Reddish Chestnut. This soil occupies a very large alluvial plain or lake bed, and is said to be somewhat similar to the soil on the "Darling Downs" to the north. The land is used mainly for wheat, with some grain sorghum.

We continue on west, and about 8 miles beyond Oakey stop in the same general plain to see a dark-colored soil

with retarded drainage that is related to the black soil already described as Sample No. 3.

Here the native cover had some trees, and apparently the surface soil does not crack so prominently as the characteristic subtropical black clays, and is not now self-mulching to a great extent. I am told that the soil is locally regarded as a "black earth" and perhaps related to a Chernozem. Some speak of it as a "degraded Chernozem" because of the "fixation" of the A by the roots of the vegetation! Certainly, I shouldn't regard this process as degradation. The soil does seem nearer Chernozem than the one at Gatton; but it is even more suggestive of a Wiesenboden. It belongs with the subtropical black clays, but on the margin of the group. Here, also, we have only the big auger, and it is hard to examine the soil properly.

- | | | |
|--------------------------------|---------|--|
| A _p | 0-6" | Dark grayish-brown to black clay, with coarse, rounded nut structure. (There may have been some added dust mixed in the surface in recent years. The soil is not so hard and not so cracked as the one at Gatton.) |
| B | 6-15" | Black clay, with angular nut structure. |
| B ₃ -C _c | 15-34" | Black, heavy clay. Somewhat more friable than above, with small "eyes" of lime or gypsum. |
| C _s | 34-36"+ | Mottled dark gray and light gray, sticky clay, with many crystals of gypsum. |

with retarded drainage that is related to the black soil

already described as Sample No. 3.

Here the native cover had some trees, and apparently

the surface soil does not crack so prominently as the

characteristic subtropical black clays, and is not now

self-mulching to a great extent. I am told that the soil

is locally regarded as a "black earth" and perhaps related

to a Chernozem. Some speak of it as a "degraded Chernozem"

because of the "fixation" of the A by the roots of the

vegetation! Certainly, I shouldn't regard this process as

degradation. The soil does seem nearer Chernozem than the

one at Gattou; but it is even more suggestive of a Wiesbaden

It belongs with the subtropical black clays, but on the margin

of the group. Here, also, we have only the big sugar, and

it is hard to examine the soil properly.

A_p 0-6"

Dark grayish-brown to black clay,
with coarse, rounded nut structure.
(There may have been some added dust
mixed in the surface in recent years.
The soil is not so hard and not so
cracked as the one at Gattou.)

B 6-15"

Black clay, with angular nut structure.

B₂-C₂ 15-34"

Black, heavy clay. Somewhat more
friable than above, with small "eyes"
of lime or gypsum.

C₂ 34-36"+

Mottled dark gray and light gray, sticky
clay, with many crystals of gypsum.

We turn south and drive 4 miles into a flat, slightly depressed area of black, self-mulching clay. If anything, this is an even more extreme example than the one seen at Gatton.

A ₁₁	0-4"	Very dark brown to black clay, with coarse, granular and hard, subangular structure.
A ₁₂	4-8"	Black clay, with hard angular blocks.
B ₂	8-20"	Black, massive clay, that breaks irregularly into blocks 2 to 6 inches in diameter. Noticeable vertical cracking.
B ₃	20-36"	Black clay, similar to above, but with some small white flecks.
C	36" +	Grayish-brown clay, with white flecks. More friable than above.

I try to photograph the low, but well-developed, micro-relief, where the land is covered with the natural grass. This is obviously an old ponded plain. The soil is imperfectly drained and moves about a good deal with wetting and drying -- enough so to move the posts and thus make fencing difficult.

Possibly these soils belong with the Regur and the other tropical, high magnesium clays. Although dark in color, the content of organic matter is said to be low. The soil here looks much like the McKenzie clay of western

We turn south and drive 1/2 miles into a flat, slightly depressed area of black, self-mulching clay. If anything,

this is an even more extreme example than the one seen at

Gaston.

Very dark brown to black clay, with coarse, granular and hard, subangular structure.	0-4"	A ₁₁
Black clay, with hard angular blocks.	4-8"	A ₁₂
Black, massive clay, that breaks irregularly into blocks 2 to 6 inches in diameter. Noticeable vertical cracking.	8-20"	B ₂
Black clay, similar to above, but with some small white flecks.	20-36"	B ₃
Grayish-brown clay, with white flecks. More friable than above.	36" +	C

I try to photograph the low, but well-developed, micro-

relief, where the land is covered with the natural grass.

This is obviously an old ponded plain. The soil is imper-

fectly drained and moves about a good deal with wetting and

drying -- enough so to move the posts and thus make fencing

difficult.

Possibly these soils belong with the Regur and the

other tropical, high magnesium clays. Although dark in

color, the content of organic matter is said to be low.

The soil here looks much like the McKenzie clay of western



K-1626 January 14, 1949
Australia. Queensland. 8 miles west, 4 miles south
of Oakey. Micro-relief of "black earth" -- a black
self-mulching clay. (Mr. Hubble)

North Dakota, and resembles somewhat the heaviest types among the black soils south of Algiers.

We drive on south a little way and then east in the direction of Brisbane. I see a lot of reddish-black to reddish-brown soils over basalt, with fairly thin sola. Many of these have very thin stands of eucalyptus with pasture grass. Most of the trees have been "ring-barked" (= girdled).

The pattern of local soil types is quite intricate. Where the soils are deep, I see some nice farmsteads with good homes and pleasant gardens. Most of these have rather short windmills with steel storage tanks for water. The reddish-brown soils on the upland, thin over basalt, are commonly associated with black clays in the lowlands. Most of these reddish-black soils from basalt are on rather gentle slopes, although some go up to 6 and 7 percent.

We look at a railway cutting near the edge of Toowoomba in the "red loam" or "red laterite." The rocks have deeply weathered, and the material is characteristically mottled in the lower part.

We drive out to a high point on the edge of town. It seems to me that the local architecture is distinctive and different from any I have seen. Something about it suggests

southern France; but it is not the same, partly because of the sheet-iron roofs, many of which are painted red.

About 6:00, we start back to Brisbane -- 82 miles.

We stop in Gatton for dinner. This is a gorgeous moon-lit night, but it is most too long a drive after such a day.

Just as I am getting ready for bed, I find a note to call the air office. More difficulty over my tickets, so I shall have some "office work" the first thing in the morning.

These low-lying black soils I have seen worry me a bit. Certainly, they shouldn't be called "black earth" with any implication of Chernozem. They are definitely intrazonal. They likely belong with the tropical and sub-tropical self-mulching black clays. But these are not yet properly described or named.

a soil with a pedregal profile underlain by the strongly weathered lateritic clay having characteristic reticulate mottling.

We only have a few minutes to look at this soil before going to the airport.

A₁ 3-4" Deepest, grayish-brown, fine sandy loam. Fairly easily friable to soft crumb.

A₂ 7-15" Olive-yellow, light, fine sandy loam, much lighter in color when dry. Some soft, dark brown concretions.

January 15

I am up at 5:45 and packed for the trip to Cairns. Mr. Wells of the Queensland Department of Agriculture calls at 9:00 for a discussion about how to organize advisory and demonstration work for both conservation and production practices. He points out that in New South Wales a separate program has been begun for soil conservation quite apart from the work of the Department of Agriculture. He says this has created a situation that is becoming intolerable.

I cash a check at the bank, and go to the air office and pick up my tickets as far as Adelaide. Then Mr. Hubble and Professor Teakle take me out to the Sandgate Council Quarry to see a "red laterite."

This soil reminds one of Dr. Marbut's ideal Laterite -- a soil with a podzolic profile underlain by the strongly weathered lateritic clay having characteristic reticulate mottling.

We only have a few minutes to look at this soil before going to the airport.

A _p -1	0-7"	Compact, grayish-brown, fine sandy loam. Fairly easily friable to soft crumb.
A ₂	7-18"	Olive-yellow, light, fine sandy loam, much lighter in color when dry. Some soft, dark brown concretions.

January 15

I am up at 5:45 and packed for the trip to Cairns.
Mr. Wells of the Queensland Department of Agriculture
calls at 9:00 for a discussion about how to organize
advisory and demonstration work for both conservation and
production practices. He points out that in New South
Wales a separate program has been begun for soil conservation
quite apart from the work of the Department of Agriculture.
He says this has created a situation that is becoming
intolerable.
I cash a check at the bank, and go to the air office
and pick up my tickets as far as Adelaide. Then Mr. Hubble
and Professor Teske take me out to the Sandgate Council
Quarry to see a "red laterite".
This soil reminds me of Dr. Murray's ideal laterite -
a soil with a pedologic profile underlain by the strongly
weathered lateritic clay having characteristic reticulate
mottling.

We only have a few minutes to look at this soil before
going to the airport.

Ap-1	0-7"	Compact, grayish-brown, fine sandy loam. Fairly easily friable to soft crumb.
A2	7-13"	Olive-yellow, light, fine sandy loam, much lighter in color when dry. Some soft, dark brown concretions.



K-1627 January 15, 1949
Australia. Queensland. Near Brisbane in Sandgate
Council Quarry. "Red loam" with laterite.



K-1628 January 15, 1949
Australia. Queensland. Near Brisbane in Sandgate Council
Quarry. "Red loam" with laterite. Note highly mottled
zone. Prof. Teakle (L), Mr. Hubble (R).

- A₃ 18-24" Yellowish-red (when moist), light, fine sandy clay loam, faintly mottled with lighter and darker shades. Massive in place, but fairly easily friable. This changes abruptly to:
- B 24-60"? Red clay. Massive, but fairly easily friable.

The slope here is about 3 percent, but the surface may have been disturbed. Where the solum above the B has been removed, there is a slight hardening, resulting in a pavement with loose concretions lying on it. The surface solum resembles a Red-Yellow Podzolic soil; the B is what I should like to see in a Red Latosol; and the C suggests Ground-Water Laterite.

I look at the B material in a deep cut, where the soil has been truncated somewhat. It is a red clay loam (10R 4/6). The soil is massive in place, but is easily friable to a crumb structure. There are many small dark reddish-brown concretions. These are larger and more abundant in the zone beneath.

It is hard to estimate depth here, but at about 5 or 6 feet the material is slightly hardened. It is mottled red, reddish-yellow, reddish-black, and gray. The color and structure are characteristic of laterite, but not so hard as one expects.

At about 10 to 14 feet, and deeper, the mottling becomes coarser and the amount of gray increases. This material looks a good deal like that under the Ground-Water Laterites near Elisabethville in the Belgian Congo, but is not so hard.

One question is: Is the upper solum, say the upper 24 inches, developed from the laterite material or from a layer put down later? Professor Teakle holds the former view. I suspect that the whole soil, including the laterite, developed together at the same time, but that now the water table has disappeared. The deep rocks are not to be seen, but are probably sandstone.

We go directly to the airport for lunch, and find that the plane is a bit late. We are in the air at 2:15 p.m., out of the Eagle Farm Airport. It is clear, but hazy.

We fly north along the coast, much further to sea than the route maps given me by the airline indicate. First we are over sea, then I get a look at the land near Tin Can Bay. Near the coast, the land is generally forested, but a little way back, it is perhaps one-half cleared. After Urangan, we are again over the sea, but return to the land and fly over Bundaberg, south of which I see some well-cultivated reddish-brown soil in large patches.

CAIRNS - BRISBANE

Distance
in Miles
from
Cairns

Distance
in Miles
from
Cairns

CAIRNS

The winter climate of this sea-resort attracts large numbers of tourists, who set out from here to explore the wonders of the Great Barrier Reef and the nearby Atherton Tablelands. A tour through the tropical jungle of the tablelands, reveals the beautiful crater-lakes Barrine and Eacham, the Barron Falls, the Kuranda Falls and the contrast of tall-timber and rich pastoral country. The tablelands will be recalled by thousands of Australian soldiers, who trained in these areas for the New Guinea campaign in World War II.

TOWNSVILLE

Townsville is the largest city in northern Queensland. It is an important seaport, being the outlet for much of North Queensland's export trade. Scenic holiday resorts such as Magnetic Island and Palm Island may be reached by launch excursions. The population of Townsville is 31,414.

WHITSUNDAY PASSAGE

North of Mackay, this sixty-miles stretch of water threads its way through the numerous tropical islands of the picturesque Whitsunday Archipelago. The waters of these islands provide excellent reef and game fishing. For tropical, scenic beauty the placid waters of this passage, and the contrast in the topography of the islands, are unequalled in Australia.

MACKAY

Mackay, situated at the mouth of the Pioneer River, provides attractive scenic island cruises and fishing of all kinds for the tourist, including deep sea and reef angling. Tropical fruits, sugar cane, dairy produce and tobacco are amongst the products exported from this port. Mackay's population is approximately 12,000.

ROCKHAMPTON

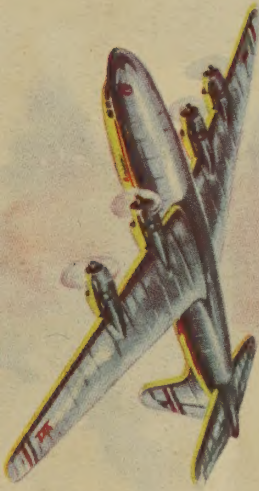
Rockhampton is a prosperous town with a population of 36,000, and is situated 38 miles from the mouth of the Fitzroy River, just north of the Tropic of Capricorn. It is an important shipping port, being the outlet for many products of the surrounding districts, the most important of these being cattle, sheep, cotton, dairy produce and copper. The meat freezing-works are the largest in Australia.

From Brisbane

DISTANCE

0
856
40
516
80
776
120
736
160
696
200
656
240
616
280
576
320
536
360
496
400
456
378
440
416
480
376
553
520
336
560





TAA BOOKING OFFICES THROUGHOUT AUSTRALIA

MELBOURNE—	339 Swanston Street	-	-	-	MY 310
SYDNEY—	119 Phillip Street	-	-	-	BO 526
BRISBANE—	Cnr. Adelaide and Creek Streets	-	-	-	B 1341
ADELAIDE—	Anchor House, 142 North Terrace	-	-	-	Cent. 7545
PERTH—	National House, 49 William Street	-	-	-	B 2453
HOBART—	Cnr. Collins and Argyle Streets	-	-	-	7411
LAUNCESTON—	Cnr. Brisbane and George Streets	-	-	-	2061
BURNIE—	30 Wilmot Street	-	-	-	159
NEWCASTLE—	Managing Agents, Messrs. Howard Smith & Co. Ltd., Watt Street	-	-	-	Newcastle B 1351
DARWIN—	Hotel Darwin	-	-	-	241. After hours 242
CAIRNS—	School of Arts Building, 95 Lake Street	-	-	-	3152, 3356

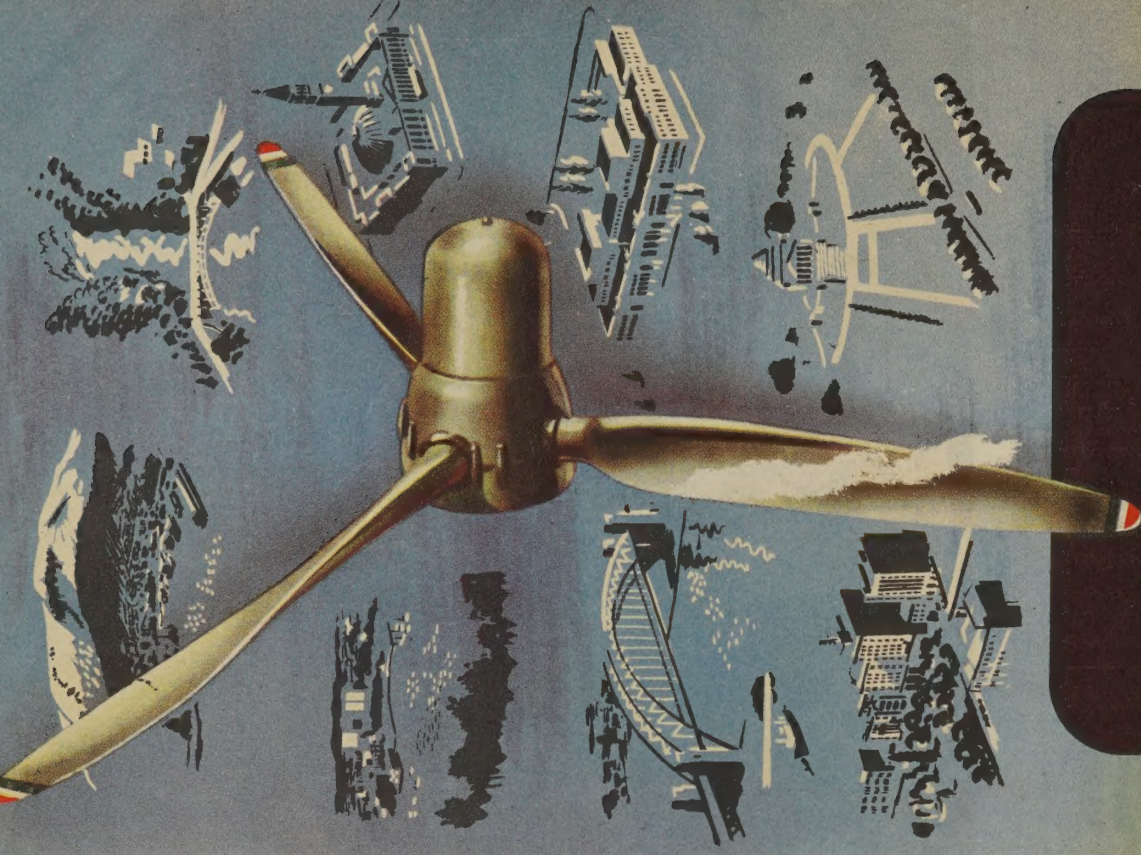
AND AT . . .

CANBERRA, MT. EBA, OODNADATTA, ALICE SPRINGS,
TENNANT CREEK, DALY WATERS, KATHERINE, MILDURA,
ROCKHAMPTON, MACKAY, TOWNSVILLE, COROWA,
NARRANDERA, CHARTERS, TOWERS, JULIA CREEK,
CLONCURRY, MT. ISA, GRIFFITH, HUGHENDEN, WINTON,
LONGREACH and RICHMOND.

TAA ARE AGENTS FOR

QANTAS EMPIRE AIRWAYS, AIRLINES (W.A.) LTD., MAC-
ROBERTSON MILLER AVIATION CO. LTD., CONNELLAN
AIRWAYS, NEW ENGLAND AIRWAYS, INTERSTATE AIR
SERVICES PTY. LTD., EAST WEST AIRLINES LTD., ANSETT
AIRWAYS PTY. LTD.

Trans-Australia Airlines



MAPS OF THE
TAA
ROUTES

LADSTONE

Ladstone has a population of approximately 1,000, and has many islands close to it. Romantic legends are associated with possible early visits of Spaniards, for Spanish inscriptions carved on rock, and an old gun, are said to have been found in the district.

MUNDABERG

On the Burnett River, 217 miles from Brisbane, Mundaberg is in the rich, red-soiled canefield area, and is well-known for its sugar and by-products, including rum. Tobacco, dairy produce and timber are among other products of this rich area. Bert. Hinkler was born in this district. He learned much of his skill flying gliders, which he built himself. Gladys Moncrieff, world-famous soprano, hails from Mundaberg.

MARYBOROUGH

Maryborough, with a population of approximately 15,000, is one of the largest towns on the Mary River. It is a notable industrial centre, with rail and shipping workshops. Sugar cane is grown extensively in this district.

GYMPIE

Gympie is situated on the Mary River. The district produces pineapples and sugar, and the town, itself, is an important rail centre. In 1867, Queensland's first gold was found in this area by a prospector named Nash. A nugget of 1,000 oz. was taken from this field.

KINGAROY

To the south-west of our course and in the foot-hills of the Great Dividing Range, this town, with a population of 2,600, is chiefly noted for peanut growing, timber and dairying.

BRISBANE

Known as the "City of the Seven Hills," Brisbane was founded in 1824. To-day it is a busy city boasting a population of over 300,000. Many of its wide, shady streets are lined with trees and palms, whilst in private gardens tropical flowers and greenery grow in profusion. Brisbane is spread over an area bigger than that of any other capital city in Australia.

BRISBANE - CAIRNS

604

701

750

788

788

876

IN MILES
296
600
256
640
216
680
176
720
136
760
96
800
56
840
16
876

From Cairns



NAVIGATIONAL AIDS

1. Wisely planned rules and regulations have lifted the safety factor of air travel in Australia to a standard equal to that of any other country in the world. In a similar manner to the way in which highways on the ground are divided into traffic "lanes," our skyways have been divided into altitude "lanes" to ensure a clearance of 1,000 feet between aircraft flying over the same routes in opposite directions. North-bound and south-bound planes fly at even and odd intervals of 1,000 feet respectively (see diagram 1). A similar rule applies to east and west-bound craft.



2. Radio provides eyes and ears that reach out over hundreds of miles, penetrating distance by day or night and under all flying conditions. From the moment the propellers of your airliner commence to turn on the tarmac, the Captain is in touch by radio, with the Airport Control Tower, from where he receives his take-off instructions. Along the route are a number of Radio Range Stations, which transmit combinations of morse signals. Once the aircraft has climbed away from the airport, the Captain tunes in the "Radio Range Receiving Set" to the first or nearest Radio Range Station, and the movement of the vertical pointer to the right or left of the central mark on the face of the instrument shows him whether he is "on the beam," that is, flying directly along this Radio Range track. His earphones also indicate, by either "dots" or "dashes," whether he is to left or right of the "beam."

3. From time to time, the Captain checks his position by using the radio compass (see diagram 3). This device is tuned in to broadcast radio stations and special transmitting stations (known as Homer Beacons) passed en route. The radio compass indicates the direction or bearing of the Homer Beacon from the aircraft and from the cross-bearing established, the exact location of the plane can be determined.

4. The terminal airport has a Radio Range Station on the landing field, and the pilot "homes" to this station on the last stage of the journey. As he nears the airport, he gradually descends to 4,000 feet and continues down the "beam" until he is directly over the Radio Range Station. He then tunes in to the Airport Control Tower for final landing instructions.

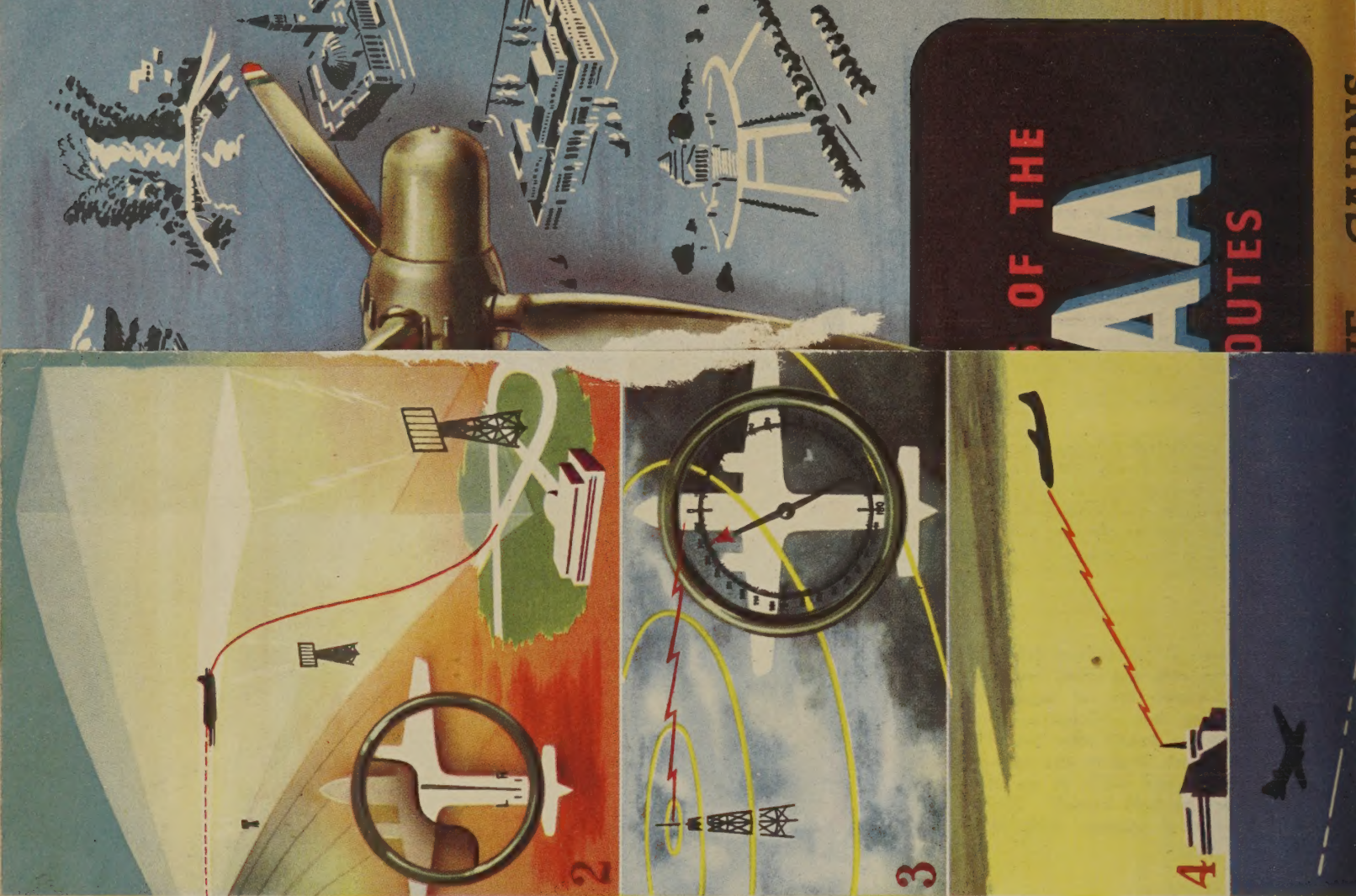
5. At half-hourly intervals during flight, the Captain is required to report his position to Air Radio Stations along the route. From these points, he also receives weather forecasts. At night, rotating light beacons, situated on aerodromes and on prominent, geographical features, flash identification signals, which give him further assistance in ascertaining his exact position.

This is a key for reference when reading your T A route maps.

MAIN ROADS

RAILWAYS

AERODROMES



Nearing Rockhampton, I see mostly thin forest with pasture for miles and miles. Many of the trees have been ring-barked, and there are a few small gullies and bare spots in some of the pastures.

We stop briefly in Rockhampton. It is very warm. At 4:45 p.m., we are on our way again. I see a few small farms, but with only a little cultivated land, except for a small area of red soil. Beyond this, as I look to the east, I see mostly rough, forested country, with rather small valleys. In these, there is some open pasture and a few fields.

We stop briefly at Mackay on the Pioneer River, which has a delta with an intricate pattern of sand bars. As we come down to land, I see large cattle pastures, with a few trees in them.

We are out of Mackay just after 6:00. I see some sugar-cane fields, but only about one-third to two-thirds of the land is clear of forest. There are many small cone-like mountains scattered about. Detailed soil survey work would be very difficult here, because of the very complicated pattern of local soil types. (In relief and complication, in soils and rocks, this reminds me of the "knob" area east of Knoxville, Tennessee.) About 20 miles out, we are over



⑨ Cairns (General.)

poorer country, with more mountains and forests. Prescott's map is certainly misleading to strangers, by omitting the large areas of lithosolic soils that probably are the most prominent in his "podsol."

It becomes cloudy. I read a bit in an Australian magazine of opinion that criticizes severely the present program of the Labour Government in Australia. I have heard a good deal of the same on the radio, and seen much of it in the newspapers. I rather suspect that possibly the Australians have a bit of an inferiority complex, somewhat like Americans had 50 years ago. I wonder if they are not doing better than they think they are?

I see some good cane land in the valley of the Burdekin River. The fields are relatively small for sugarcane. The soils are primarily Alluvial, with a few outliers of upland soils on what were islands until recently. I am told that farming is rather intensive; heavy irrigation is used. Many of these cane farms have only about 40 acres of cultivated land. Night falls as we come down at Townsville about 7:30. We are in the air again at 7:50. It is now dark, except for a beautiful moon to the east over the Coral Sea.

We are down at Cairns at 9:00 p.m., and I go to the Strand Hotel. This is a typical, noisy, tropical hotel

on Saturday night, with banging pianos and much gayety. My room is a long way from the bath, but overlooks the sea. There is mosquito netting hung over the bed, but I am assured that there is no malaria.

I sit for a while on the wide veranda, where the moon shines brightly on the Coral Sea. This is a real tropical evening and seems good -- not hot, but very warm. The young people in the hotel are singing and laughing, but all of the songs are originated elsewhere. It will take a long time for Europeans to develop a culture that fits the tropics. Certainly now, many of them are frustrated. They look to Europe and America, and do things that don't fit, like the celebration of Christmas. Why should people in the tropics set aside a feast day to celebrate the end of the winter solstice in northern Europe?

on Saturday night, with banging pianos and much gaiety.
My room is a long way from the bath, but overlooks the sea.
There is mosquito netting hung over the bed, but I am assured
that there is no malaria.

I sit for a while on the wide veranda, where the moon
shines brightly on the Coral Sea. This is a real tropical
evening and seems good -- not hot, but very warm. The
young people in the hotel are singing and laughing, but all
of the songs are originated elsewhere. It will take a long
time for Europeans to develop a culture that fits the
tropics. Certainly now, many of them are frustrated.
They look to Europe and America, and do things that don't
fit. Like the celebration of Christmas. Why should people
in the tropics set aside a feast day to celebrate the end
of the winter solstice in northern Europe?



1:1,000,000

ST CRISPIN REEF

TRINITY OPENING

TRINITY

BAY

CAIRNS
5 L 51
CAIRNS TOWER
310 116.1 mc

CS-DF
CAIRNS
325 VZCS

R Bn
CAIRNS RADIO
310 CS

ARLINGTON REEF

CAIRNS HARBOR
00 Ls 105
CAIRNS LAUNCH
6440

GRAFTON PASSAGE

Cape Grafton

SUDBURY REEF

FLORA PASS

GREAT

Gp FI (U) 6 sec 250

5287
BARTLE FRERE

INNISFAIL
16 26
798

Mourilyan Harbor

FI (U) 5 sec 280

MT MACKAY

Dunk I

ROCKINGHAM BAY

Hinchinbrook I

January 16

I am up at 6:30, and pack for the trip to Atherton. Already it is warm, and we may expect a clear, hot day. I take a short walk before breakfast, and find the streets deserted on this Sunday morning. After breakfast, we go to the field — Mr. Hubble, Professor Teakle, and Mr. S. E. Stephens, Horticultural Officer of the Queensland Department of Agriculture. As we drive out of the city, I note that most of the houses are built on high stilts, with room to store automobiles and all sorts of things beneath.

We go north. There are high hills to the left, and a low coastal area of Alluvial soils and swamps to the sea. We pass excellent fields of sugarcane on the coastal alluvium of the Barron River.

I look at this alluvial soil.

- (1) 0-18" Dark brown fine sandy loam. Slightly compact, but very easily friable to soft granular.
- (2) 18-48"+ Very dark reddish-brown, fine sandy loam. Vesicular. Some insect casts.

The land is nearly flat and imperfectly drained. Certainly this is an excellent soil. I talk for a few minutes with the owner of the land. The new cane is usually planted in May and June, but sometimes in September. Besides the "plant" crop, they usually take two or three ratoon crops.

January 10

I am up at 6:30, and pack for the trip to Atterton.

Already it is warm, and we may expect a clear, hot day.

I take a short walk before breakfast, and find the streets

deserted on this Sunday morning. After breakfast, we go to

the field -- Mr. Hubble, Professor Taskie, and Mr. S. E.

Stephens, Horticultural Officer of the Queensland Department

of Agriculture. As we drive out of the city, I note that

most of the houses are built on high stilts, with room to

store automobiles and all sorts of things beneath.

We go north. There are high hills to the left, and

a low coastal area of alluvial soils and swamps to the sea.

We pass excellent fields of sugarcane on the coastal

alluvium of the Barron River.

I look at this alluvial soil.

(1)	0-15"	Dark brown fine sandy loam. Slightly compact, but very easily friable to soft granular.
-----	-------	---

(2)	18-48"+	Very dark reddish-brown, fine sandy loam. Vesicular. Some insect casts.
-----	---------	---

The land is nearly flat and imperfectly drained.

Certainly this is an excellent soil. I talk for a few

minutes with the owner of the land. The new cane is usually

planted in May and June, but sometimes in September. Besides

the "plant" crop, they usually take two or three ratoon crops.



K-1629 January 16, 1949
Australia. Queensland. Cairns. Typical home,
on "stilts."



K-1630 January 16, 1949
Australia. Queensland. Cairns. Typical home,
on "stilts." Another view.

The plant cane gives him 50 tons to the acre, and the ratoons about 40, in a growing season of 11 to 12 months. Sometimes, however, they cut the old cane at the end of 9 months. He tells me his cane runs about 14.28 percent of 94 percent pure sugar, on the average. He uses sulphate of ammonia or a fertilizer mixture of "B-3," high in phosphorus. He gives the cane a dressing of 200 lbs. of ammonium sulphate the last time through it. He uses the "B" mixture when planting the first crop.

The land is plowed 14 inches deep, with a heavy three-disc plow. He shows me a machine for planting the cane and adding the fertilizers in one operation. The fertilizer is placed to the side of the set.

Farms in this neighborhood have 80 to 120 acres of cane. They operate under a system of allocations made to the mills, and from them to the farms. Under the present conditions, an 80-acre farm will net about 1,000 pounds Australian.

We turn northwest into the hills toward Kuranda. The slopes have gray, yellowish-brown, and reddish-brown Lithosols from schists. On top, a little beyond the escarpment, I look at a red soil from schists under a second-growth rain forest on a 10 to 15 percent slope. The rain here is about 90 inches. The soil is called locally a "red loam." I should call it a Red Latosol.

The plant cane gives him 50 tons to the acre, and the
 returns about 40, in a growing season of 11 to 12 months.
 Sometimes, however, they cut the old cane at the end of 9
 months. He tells me his cane runs about 14.28 percent of
 94 percent pure sugar, on the average. He uses sulphate
 of ammonia or a fertilizer mixture of "B-3," high in
 phosphorus. He gives the cane a dressing of 200 lbs. of
 ammonium sulphate the last time through it. He uses the
 "B-3" mixture when planting the first crop.

The land is plowed 14 inches deep, with a heavy three-
 disc plow. He shows me a machine for planting the cane and
 adding the fertilizers in one operation. The fertilizer is
 placed to the side of the set.

Farms in this neighborhood have 80 to 120 acres of cane.

They operate under a system of allocations made to the
 mills, and from them to the farms. Under the present con-
 ditions, an 80-acre farm will net about 1,000 pounds Australian.

We turn northwest into the hills toward Kuranda. The
 slopes have gray, yellowish-brown, and reddish-brown lithologic

from schists. On top, a little beyond the escarpment, I
 look at a red soil from schists under a second-growth rain
 forest on a 10 to 15 percent slope. The rain here is about
 90 inches. The soil is called locally a "red loam." I

should call it a Red Latosol.



K-1631 January 16, 1949
 Australia. Queensland. North of Cairns. Sugarcane
 on good Alluvial soil near Barron River.



K-1633 January 16, 1949
 Australia. Queensland. North of Cairns. View from
 mountains looking toward airstrip and village of
 Stratford in valley of Barron River. (Camera 1375'
 elevation)

A ₀₀ & A ₀		Very thin.
A ₁	0-6"	Subangular granular, yellowish-red (5YR 5/6), fine sandy clay loam. (May be some disturbance.)
A ₂	6-12"	Reddish-yellow (5YR 6/8), slightly compact, but easily friable, fine sandy clay loam.
A ₃	12-14"	Transitional.
B ₂	14-26"	Red (2.5YR 5/8), fine sandy clay loam. Slightly compact, but easily friable.
B ₃	26-48"	Mottled, red, reddish-yellow, and gray, fine sandy clay. There are some relics of schistose structure. The soil digs out in easily friable, slivery pieces.
C	48-60"+	Mottled red, reddish-yellow, gray, and purple rotten schists.

The roots go deep into the C. Actually, the profiles here are extremely irregular, because of slides and variations in weathering.

As I suspected, the Australian "red loam" is not nearly so earthy as that called by the same name in Africa.

We go on to the northwest. Most of the land is strongly rolling to hilly and in forest. Some of the soils are gray on the surface and yellowish-brown in the B.

On a seepy slope of about 20 percent, I see a Gray Hydromorphic soil that I describe hurriedly as follows:

A ₁₁	0-5"	Dark reddish-gray, fine sandy loam. Easily friable.
A ₁₂	5-8"	Transitional.

A ₀ & A ₁	Very thin.
A ₁	0-2"
Subangular granular, yellowish-red (2YR 5/6), fine sandy clay loam. (May be some disturbance.)	
A ₂	6-12"
Reddish-yellow (2YR 6/8), slightly compact, but easily friable, fine sandy clay loam.	
A ₃	12-14"
Transitional.	
B ₂	14-26"
Red (2.5YR 5/8), fine sandy clay loam. Slightly compact, but easily friable.	
B ₃	26-48"
Mottled, red, reddish-yellow, and gray, fine sandy clay. There are some relics of schistose structure. The soil digs out in easily friable, silvery pieces.	
C	48-60"+
Mottled red, reddish-yellow, gray, and purple rotten schists.	

The roots go deep into the C. Actually, the profiles here are extremely irregular, because of slides and variations in weathering.

As I suspected, the Australian "red loam" is not nearly so earthy as that called by the same name in Africa. We go on to the northwest. Most of the land is strongly rolling to hilly and in forest. Some of the soils are gray on the surface and yellowish-brown in the B.

On a seepy slope of about 20 percent, I see a Gray Hydromorphic soil that I describe hurriedly as follows:

A ₁₁	0-2"
Dark reddish-gray, fine sandy loam. Easily friable.	
A ₁₂	2-6"
Transitional.	

A₂-G₁ 8-20" White, slightly mottled with light gray and pale yellow, heavy, fine sandy loam.

A₃-G₂ 20-48"+ More compact, fine sandy loam, mottled with a reddish-yellow.

We pass Kuranda, then drive on through rolling Red Latosol with some spots of gray upland soils. The cover is mostly second-growth rain forest, with a little pasture land. I see a few small termite mounds, 2 to 3 feet high and 3 feet broad at the base.

About 3 miles southwest of Kuranda, we leave the rain forest and come into more open woodland with gray rocks and soils.

Four miles southwest of Kuranda, I stop to look at one of these gray upland soils on a 10 percent slope. The land is frequently fired, so there is essentially no A₀ or A₀₀ under the thin forest. There are scattered termite mounds about 2 to 4 feet high and 3 feet across. These termite mounds here are more numerous than on the "coastal podsol" near Brisbane. Then too, these are more nearly vertical. The elevation is about 1,300 feet. The trees are mainly eucalyptus, Casuarina suberosa, and some Melaleuca.

I regard the soil as a Yellow Latosol.

42-01 8-10" White, slightly mottled with light gray and pale yellow, heavy, fine sandy loam.

43-02 20-40" More compact, fine sandy loam, mottled with a reddish-yellow.

We pass Kuranda, then drive on through rolling Red laterol with some spots of gray upland soils. The cover is mostly second-growth rain forest, with a little pasture land. I see a few small territe mounds, 2 to 3 feet high and 3 feet broad at the base. About 3 miles southwest of Kuranda, we leave the rain forest and come into more open woodland with gray rocks and soils.

Four miles southwest of Kuranda, I stop to look at one of these gray upland soils on a 10 percent slope. The land is frequently fired, so there is essentially no A₀ or A₀₀ under the thin forest. There are scattered territe mounds about 2 to 4 feet high and 3 feet across. These territe mounds here are more numerous than on the "coastal podsol" near Brisbane. Then too, these are more nearly vertical. The elevation is about 1,300 feet. The trees are mainly Eucalyptus, Casuarina suberosa, and some Melaleuca.

I regard the soil as a yellow laterol.



K-1634 January 16, 1949
Australia. Queensland. Southwest of Kuranda. Vegetation
on Yellow Latosol. Mostly eucalyptus. Burned in October
1947 and again in October 1948. A few termite mounds.



K-1635 January 16, 1949
Australia. Queensland. Southwest of Kuranda. Vegetation
on Yellow Latosol. Mostly Eucalyptus. Burned in October
1947 and again in October 1948. A few termite mounds.
Another view.

- | | | |
|----------------|--------|--|
| A ₁ | 0-5" | Dark gray to dark grayish-brown (2.5Y 4/1), fine sandy clay loam. Massive, with many small pores. Vesicular. Easily friable to soft granular. |
| A ₃ | 5-15" | Grayish-brown, mottled with gray, yellow, and reddish-yellow, fine sandy clay loam with increasing yellow in the lower part. Subangular nut. Some irregular pebbles. |
| B ₂ | 15-25" | Mottled gray, pale yellow, and reddish-yellow, very fine sandy clay. Plastic. Massive to angular blocky structure, but quite friable. |
| B ₃ | 25-48" | Yellowish-gray, mottled with red and reddish-yellow, massive to coarsely blocky, heavy, very fine sandy clay or sandy loam. Large mottlings in depth with more and larger red streaks. |
| C | 48" + | Rotten schists. |

Embedded in the C are some hard quartzitic pebbles.

Small stones occur throughout the soil.

We drive on southwest through much of this stony, rolling Yellow Latosol under poor woodland pasture. The soil is considered now to be unsuitable for crops.

We cross the Clohesy River and continue southwest. We are soon into a large, smooth, upland area of the Yellow Latosol where I attempt photographs of the vegetation, which is mainly eucalyptus and grass. This area was burned in both 1948 and 1947.



K-1756 January 16, 1949
 Australia. Queensland. Southwest of Kuranda
 near Emerald Creek. Characteristic woodland with
 termite mounds on Yellow Latosol with sandy surface.

A little beyond, I see a lithosolic soil from basalt that has dark reddish-brown, stony loam some 12 to 18 inches over the cracked, massive basalt. I see also a few areas of deeper red soil -- Red Latosol from basalt. Some tobacco is growing on it.

We are soon onto a better type of Yellow Latosol with some patches of Red Latosol. I see a few small gullies, but not much erosion. Tobacco was tried here, but failed.

Just before crossing Emerald Creek, I see some tobacco on the sandy soil of an old stream terrace. After we cross the stream, we are soon off the terrace onto a gently rolling upland, as before -- Yellow Latosol with thin woodland and numerous termite mounds, 3 to 5 feet high and 3 to 4 feet across at the base.

Near Mareeba, we come onto a large river terrace with a reddish-brown soil. Here there is a good deal of tobacco. The harvest is proceeding gradually. They remove the lower leaves first, and then the upper ones later. This is used mostly for cigarettes.

We cross the deeply trenched Barron River and enter Mareeba.

We are now on the upper end of a large plateau (Atherton Tableland). The soils are red. The northern part is mostly

A little beyond, I see a lithologic soil from basalt that has dark reddish-brown, along from some 12 to 16 inches over the cracked, massive basalt. I see also a few areas of deeper red soil -- Red latosol from basalt. Some tobacco is growing on it.

We are soon onto a better type of Yellow latosol with some patches of Red latosol. I see a few small gullies, but not much erosion. Tobacco was tried here, but failed.

Just before crossing Emerald Creek, I see some tobacco on the sandy soil of an old stream terrace. After we cross the stream, we are soon off the terrace onto a gently rolling upland, as before -- Yellow latosol with thin wood-land and numerous termite mounds, 3 to 5 feet high and 3 to 4 feet across at the base.

Near Maréba, we come onto a large river terrace with a reddish-brown soil. Here there is a good deal of tobacco. The harvest is proceeding gradually. They remove the lower leaves first, and then the upper ones later. This is used mostly for cigarettes.

We cross the deeply entrenched Barton River and enter Maréba.

We are now on the upper end of a large plateau (Abaron Tableland). The soils are red. The northern part is mostly

eucalyptus woodland and grass. With increasing rainfall, this gives way to rain forest in the lower part south of Atherton.

We have lunch in Mareeba. There are said to be about 500 acres of tobacco in this area, of which 340 are irrigated. Peanuts are also grown, and cow peas for seed.

After lunch, we look hurriedly at a soil on gravelly alluvium, $1\frac{1}{2}$ miles north of the town. This is on a gently undulating old terrace. The cover is a thin forest. There are a few gray termite mounds. Sometime ago, tobacco was grown here, but not now. With cultivation, the soil gets very loose, and then a hard crust forms after a rain. It is not considered productive now.

It is difficult to decide between Yellow Latosol and Yellow Podzolic.

A ₁	0-3"	Dark grayish-brown sandy loam. Easily friable.
A ₂	3-12"	Light yellowish-brown, light sandy loam. Easily friable.
A ₃	12-21"	Light yellowish-brown, light sandy loam, with many black concretions about $1/8$ to $1/4$ inch in diameter. Slight mottling of gray.
B ₂	21-44"	Reddish-brown, light, gritty, coarse sandy clay loam. Massive to indistinctive blocky. Somewhat plastic when wet, and hard when dry, but easily friable when moist.

eucalyptus woodland and grass. With increasing rainfall, this gives way to rain forest in the lower part south of Aberton.

We have lunch in Karaba. There are said to be about

300 acres of tobacco in this area, of which 350 are irrigated. Pennants are also grown, and cow peas for seed.

After lunch, we look hurriedly at a soil on gravelly alluvium, $\frac{1}{2}$ mile north of the town. This is on a gently undulating old terrace. The cover is a thin forest. There are a few gray termite mounds. Sometimes ago, tobacco was grown here, but not now. With cultivation, the soil gets very loose, and then a hard crust forms after a rain. It is not considered productive now.

It is difficult to decide between Yellow Latosol and

Yellow Podsol.

A ₁	0-3"	Dark grayish-brown sandy loam. Easily friable.
A ₂	3-12"	Light yellowish-brown, light sandy loam. Easily friable.
A ₃	12-21"	Light yellowish-brown, light sandy loam, with many black concretions about $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter. Slight mottling of gray.
B ₂	21-44"	Reddish-brown, light, gritty, coarse sandy clay loam. Massive to indurative blocky. Somewhat plastic when wet, and hard when dry, but easily friable when moist.

- B₃ 44-56" Like the above, but lighter in texture.
- C-G 56" + Somewhat sticky, light gray, light, coarse sandy clay loam or sandy loam. Moist.

We drive south of Mareeba on smooth plains of dark reddish-brown loamy soil, shallow over basalt, with thin woodland and grass. About $1\frac{1}{2}$ miles south of Mareeba, we look at this soil hurriedly.

- A₁ 0-5" Dark reddish-brown granular clay loam or clay, with small dark reddish-brown rounded concretions.
- A₂ 5-20" Reddish-yellow, friable clay loam or clay, with small rounded concretions.
- B 20-30"+ Dark red, friable clay, mottled with reddish-yellow and reddish-brown. Many small concretions.

In the soil are numerous large, rounded boulders of basalt with characteristic concentric weathering. These are plentiful below 2 or 3 feet. Although fertile, the soil is too stony to cultivate. Although, some maize and peanuts are grown where the boulders are not too bad.

Likely this should go with the Reddish-Brown Latosols.

Another 2 miles south, I see a similar soil, more red, with a few small termite mounds, 1 to 2 feet high. Large areas here could be used for crops.

We drive south of Maricao on smooth plains of dark
 reddish-brown loamy soil, shallow over basalt, with thin
 woodland and grass. About 1 1/2 miles south of Maricao, we
 look at this soil hurriedly.

A ₁ 0-5"	Dark reddish-brown granular clay loam or clay, with small dark reddish-brown rounded concretions.
A ₂ 5-30"	Reddish-yellow, friable clay loam or clay, with small rounded concretions.
B 30-30"+	Dark red, friable clay, mottled with reddish-yellow and reddish-brown. Many small concretions.

In the soil are numerous large, rounded boulders of
 basalt with characteristic concentric weathering. These
 are plentiful below 2 or 3 feet. Although fertile, the soil
 is too stony to cultivate. Although, some maize and pas-
 nute are grown where the boulders are not too bad.
 Likely this should go with the Reddish-Brown Latosols.
 Another 2 miles south, I see a similar soil, more red,
 with a few small ferrite mounds, 1 to 2 feet high. Large
 areas here could be used for crops.

C-0 50" +
 Somewhat sticky, light gray, light,
 coarse sandy clay loam or sandy loam.
 Moist.

B₂ 44-50"
 Like the above, but lighter in
 texture.

Nine miles south of Mareeba, I examine soil under thin eucalyptus woodland where the slope is only 1 to 2 percent. Kangaroo grass (Themeda australia) grows in small clumps, leaving about one-half of the surface bare. The rainfall here is about 40 inches. Locally, this soil is called a "red loam," but I should be inclined to call it a Red Latosol from basalt.

Sample No. 4

- | | | |
|-----------------|--------|---|
| A ₁₀ | 1/16" | Dark red surface skin. ^{1/} (10R 3/3 - dusky red) |
| A ₁ | 0-5" | Dusky red (10R 3/3) clay. Finely and softly granular under slight pressure. (10R 3/4 - dusky red) |
| A ₃ | 5-11" | Dusky red (10R 3/4) clay. Slightly compact in place, but fairly easily friable. (10R 3/6 - dark red) |
| B | 11-42" | Dark red (10R 3/6) clay. Slightly compact, but easily friable. Some <u>very</u> small, nearly black concretions. (Sample B(1) taken at 15 inches and sample B(2) at 42 inches. Both 10R 4/6 - red.) |

The basalt is deep. Roots extend to at least 42 inches.

Only a little land is farmed here, but much more could be.

A little beyond, I see a yellowish-brown soil with many small dark red concretions. This is developed from some more

1/ I know this is where I lost my pocket knife. I might find it some day.

siliceous parent material that is far too deep to examine with the auger. The yellowish-brown color extends to about 6 feet. This is a Yellow Latosol.

While examining this soil, a fellow named Kelley stops to visit. He typifies the new settler wherever you find him, in Alaska or in Africa. He is a strong individualist, apparently works hard, has a lot of enthusiasm, and many ideas, both good and bad. He tells us he has just come from lunch, yet he is covered with dust from the red soil, which has been moistened by sweat to a thick paste. He tells me that this is a neglected country. The government doesn't give the settlers enough help in getting started. For example, they badly need cannaries for their fruit; but, he continues, it is no use to talk to the politicians. All the settler can do is to make a go of it in spite of the politicians and then show them the results.

He seems to have had a lot of trouble. He told me about coming home after a considerable absence to find his pineapples on fire. I guess that would be possible, but I never heard of it before. A good deal of this land could be used for pineapples, if there were a market. He says that the land is now held at about 1 pound Australian per acre.

siliceous parent material that is far too deep to examine with the auger. The yellowish-brown color extends to about 6 feet. This is a Yellow Latosol.

While examining this soil, a fellow named Kelley stops to visit. He typifies the new settler wherever you find him, in Alaska or in Africa. He is a strong individualist, apparently works hard, has a lot of enthusiasm, and many ideas, both good and bad. He tells us he has just come from Linnch, yet he is covered with dust from the red soil, which has been moistened by sweat to a thick paste. He tells me that this is a neglected country. The government doesn't give the settlers enough help in getting started. For example, they badly need canneries for their fruit; but, he continues, it is no use to talk to the politicians. All the settler can do is to make a go of it in spite of the politicians and then show them the results.

He seems to have had a lot of trouble. He told me about coming home after a considerable absence to find his pineapples on fire. I guess that would be possible, but I never heard of it before. A good deal of this land could be used for pineapples, if there were a market. He says that the land is now held at about 1 pound Australian per

About the time he is telling me that it was the Italian immigrants that taught the farmers how to farm, my companions insist that we must move on.

We drive on south toward Atherton. I see maize said to yield 20 to 40 bushels per acre growing on good Red Latosol from basalt. There is a large area of this good red soil here. I see maize in all stages of growth, from new plantings to crops 6 feet high. The plantings are widely spaced; no fertilizers are used, no manure, and essentially no legumes in the rotation. In fact, there doesn't seem to be much in the way of rotation. There is some sheet erosion and some small gullies near the lower part of long slopes -- gullies that could easily be controlled with strip cropping. A few other gullies have been started from the effects of improper highway drainage design.

About 3:30 we enter Tolga and turn east to Kairi. Here there is nice red soil with a good deal of maize and some peanuts. The country is quite open. The farms look prosperous, and a few mechanical harvesters are now being used.

We pass Kairi (very dry and hot) and drive east to an experimental farm of the Queensland Department of Agriculture. This station was used for farm production during the war, and is only now being reconverted, partly

About the time he is telling us that it was the Italian immigrants that taught the farmers how to farm, my companions insist that we must move on. We drive on south toward Aberdeen. I see maize said to yield 20 to 40 bushels per acre growing on good Red Latosol from basalt. There is a large area of this good red soil here. I see maize in all stages of growth, from new plantings to crops 6 feet high. The plantings are widely spaced; no fertilizers are used, no manure, and essentially no legumes in the rotation. In fact, there doesn't seem to be much in the way of rotation. There is some sheet erosion and some small gullies near the lower part of long slopes -- gullies that could easily be controlled with strip cropping. A few other gullies have been started from the effects of improper highway drainage design. About 3:30 we enter Toiyas and turn east to Kairi. Here there is nice red soil with a good deal of maize and some peanuts. The country is quite open. The farms look prosperous, and a few mechanical harvesters are now being used. We pass Kairi (very dry and hot) and drive east to an experimental farm of the Queensland Department of Agriculture. This station was used for farm production during the war, and is only now being reconstructed, partly

to research and partly to demonstration. We have tea with the Station Director, Mr. W. G. Straughan, and his wife. He tells me that there is small advantage from fertilizers on maize, and they are doing some experimental work. I suspect that they could get much better results if they tightened up the spacing at the same time they used the fertilizers, and if they would split the nitrogen into two applications. They have been trying one cwt.^{1/} of ammonium sulphate and two cwt.; one cwt. of superphosphate and two cwt.; and one cwt. of potassium sulphate and one-half cwt. They tried these in various combinations applied in the drills before planting, without much response. They got better responses on the rather dry red soils from basalt. The yield was lifted from 24 bushels to 53 bushels with 2 cwt. of ammonium sulphate and one cwt. of superphosphate. They have had no response to potassium.

Here the rainfall is 52 inches, and in the southern part of the tableland it goes to over 100 inches. The pH of the plowed soil goes from 7 to 5. In addition, he tells me that on this tableland there are some 30,000 acres of cultivated land, of which, 24,000 to 25,000 are in maize. The balance is peanuts, lucerne, oats, fallow (not intentional!), and a very few vegetables. There is little

^{1/} 112 lbs.

to research and partly to demonstration. We have tea with

the Station Director, Mr. W. G. Strangman, and his wife.

He tells me that there is small advantage from fertilizers

on maize, and they are doing some experimental work. I

suspect that they could get much better results if they

lightened up the spacing at the same time they used the

fertilizers, and if they would split the nitrogen into two

applications. They have been trying one cwt. $\frac{1}{2}$ of ammonium

sulphate and two cwt.; one cwt. of superphosphate and two cwt.;

and one cwt. of potassium sulphate and one-half cwt. They

tried these in various combinations applied in the drills

before planting, without much response. They got better

responses on the rather dry red soils from basalt. The

yield was lifted from 24 bushels to 29 bushels with 2 cwt.

of ammonium sulphate and one cwt. of superphosphate. They

have had no response to potassium.

Here the rainfall is 52 inches, and in the southern

part of the tableland it goes to over 100 inches. The pH

of the plowed soil goes from 7 to 8. In addition, he tells

me that on this tableland there are some 30,000 acres of

cultivated land, of which, 24,000 to 25,000 are in maize.

The balance is peanuts, lucerne, oats, fallow (not inten-

tional!), and a very few vegetables. There is little

dairying, and the pasture is dependable the year around. But the principal crop is continuous maize, sold mostly for human food in things like corn flakes. Of course, there is some erosion. The remarkable thing is that there isn't a great deal more. Most of this erosion could be easily stopped, I believe, with contour tillage and strip cropping. But farmers seem to be slow to see the importance of it. This is a pity, because the erosion could be controlled now and productivity maintained or increased, whereas the problem will become serious in a few more years. But with average yields of maize at 32 bushels to the acre, and an average price of 6 shillings, farmers are quite well satisfied.

We leave this station and stop to look at a soil just a little north of Atherton, on a very gentle slope of around 2 percent. It is called locally "a red loam of the rain forest" from basalt. These soils are quite similar to the Reddish-Brown Latosols, and possibly should go with them. But they seem to me to be too red. From conversations with my guides, I suspect that too much emphasis is given to the presence or absence of concretions in the naming of the higher categories.

I look at the soil in an area of tropical rain forest that has had some selective cutting.

Sample No. 5 (Profile incomplete)

A ₀₀	1-0"	Leaf litter.
A ₁₀	0-2"	Reddish-black, softly granular clay. (A bit darker than 10R 3/3 - dusky red)
A ₁₁	2-25"	Very dusky red, granular clay. Firm, and somewhat rubbery in place, but easily friable when removed. A very few very soft concretions that look like the soil itself. (10R 3/3 - dusky red to 2.5YR 3/4 - dark reddish-brown)
B or A ₃	25-40"+	Like the above, but somewhat more plastic. (2.5YR 3/4 - dark reddish- brown to 10R 3/6 - dark red)

There is no cut, and too little time to make a proper trench.

We arrive at Atherton at 6:15. After dinner we have a discussion of the soils we have seen, and Professor Teakle shows me some data from the laboratories of the CSIR on selected samples that he took in this general region with the big soil auger.

I am to bed at 9:45, with the music of the rain on a steel roof. It is nice and warm, almost hot.

Added later: Professor L. J. H. Teakle gave me a mimeographed copy of his Notes on the soils of Coastal Queensland and portions of the hinterland in which he reports on profiles examined during July and August 1947. He describes the climate, geology, vegetation, and main groups

Sample No. 2 (Profile incomplete)		
A ₀₀	1-0"	leaf litter.
A ₁₀	0-2"	reddish-black, soft granular clay. (A bit darker than 10R 3/3 - dusky red)
A ₁₁	2-25"	Very dusky red, granular clay, firm, and somewhat rubbery in place, but easily friable when removed. A very few very soft concretions that look like the soil itself. (10R 3/3 - dusky red to 2.5YR 3/4 - dark reddish-brown)
B or A ₂	25-40"+	Like the above, but somewhat more plastic. (2.5YR 3/4 - dark reddish- brown to 10R 3/6 - dark red)

There is no cut, and too little time to make a proper

trench.

We arrive at Atherton at 6:15. After dinner we have
a discussion of the soils we have seen, and Professor Taskie
shows me some data from the laboratories of the CSIR on
selected samples that he took in this general region with
the big soil auger.

I am to bed at 9:45, with the music of the rain on a

steel roof. It is nice and warm, almost hot.

Added later: Professor L. J. H. Taskie gave me a

micrographed copy of his Notes on the soils of Coastal
Queensland and portions of the hinterland in which he reports
on profiles examined during July and August 1947. He
describes the climate, geology, vegetation, and main groups

of soils as he sees them. Very brief descriptions of 15 soil profiles, apparently examined mostly only with a large auger, are included. Attached to this report are some mechanical analyses and chemical data on part of the soil horizons.

Below are given some of the data on soils similar to those examined by me in Queensland.

7. Depth	0 - 7	30 - 50	90 - 100
8. Colour (Munsell)	10YR	10YR	10YR
9. Texture	Clay loam	Clay loam	Clay loam
10. pH	6.3	6.3	6.3
11. CaCO ₃	-	-	-
12. Coarse sand	7.0	1.0	-
13. Fine sand	28.0	8.0	-
14. Silt	26.0	16.0	-
15. Clay	16.0	74.0	-
16. Loss on ignition	14.9	11.8	5.3
17. Organic carbon	2.21	-	-
18. Nitrogen	0.235	-	-
19. P ₂ O ₅	0.119	-	-

of soils as he sees them. Very brief descriptions of
15 soil profiles, apparently examined mostly only with a
large auger, are included. Attached to this report are
some mechanical analyses and chemical data on part of the
soil horizons.

Below are given some of the data on soils similar
to those examined by me in Queensland.

1. Kellogg's tentative name	Red Latosol		
2. Local soil group name	Red loam		
3. Location	5 miles south of Atherton		
4. Parent material or rock	Basalt		
5. Native vegetation	Rain forest - (Maize)		
6. Approximate rainfall	55 inches		
7. Depth	0 - 7	30 - 54	92 - 100
8. Colour (Teakle)	DRB	BR	B
9. Texture	Clay loam	Clay loam	Clay loam
10. pH	6.3	5.3	4.6
11. CaCO_3	-	-	-
12. Coarse sand	7.0	1.0	-
13. Fine sand	18.0	8.0	-
14. Silt	26.0	16.0	-
15. Clay	46.0	74.0	-
16. Loss on ignition	15.9	11.8	5.3
17. Organic carbon	2.21	-	-
18. Nitrogen	0.235	-	-
19. P_2O_5	0.419	-	-

1.	Kellogg's tentative name	Red Island
2.	Local soil group name	Red loam
3.	Location	5 miles south of Aberdeen
4.	Parent material or rock	Basalt
5.	Native vegetation	Rain forest - (Malaya)
6.	Approximate rainfall	52 inches
7.	Depth	0 - 7 30 - 54 35 - 100
8.	Colour (Testle)	IRB BR B
9.	Texture	Clay loam Clay loam Clay loam
10.	pH	6.3 5.3 4.5
11.	CaCO ₃	- - -
12.	Coarse sand	7.0 1.0 -
13.	Fine sand	18.0 8.0 -
14.	Silt	22.0 15.0 -
15.	Clay	16.0 74.0 -
16.	Loss on ignition	15.9 11.8 5.3
17.	Organic carbon	2.21 -
18.	Nitrogen	0.235 -
19.	P ₂ O ₅	0.119 -

1. Kellogg's tentative name	Red Latosol		
2. Local soil group name	Red loam		
3. Location	2 miles south of Malanda		
4. Parent material or rock	Basalt		
5. Native vegetation	Rain forest		
6. Approximate rainfall	70 inches		
7. Depth	0 - 6	12 - 30	57 - 66
8. Colour (Teakle)	RB	BR	BR
9. Texture	Clay loam	Clay	Clay
10. pH	5.6	5.4	5.1
11. CaCO_3	-	-	-
12. Coarse sand	12.0	1.0	-
13. Fine sand	28.0	11.0	-
14. Silt	26.0	17.0	-
15. Clay	31.0	69.0	-
16. Loss on ignition	26.9	16.2	5.3
17. Organic carbon	6.42	-	-
18. Nitrogen	0.602	-	-
19. P_2O_5	0.450	-	-
20. Exchangeable Ca	-	3.89 (68)	-
21. Exchangeable Mg	-	1.02 (17)	-
22. Exchangeable K	-	.59 (10)	-
23. Exchangeable Na	-	.43 (7)	-
24. Exchangeable Cations	-	5.93	-

1.	Kellogg's tentative name	Red laterol
2.	Local soil group name	Red loam
3.	Location	2 miles south of Malanda
4.	Parent material or rock	Basalt
5.	Native vegetation	Rain forest
6.	Approximate rainfall	70 inches
7.	Depth	0 - 6 12 - 30 27 - 66
8.	Colour (Munsell)	RB BR BR
9.	Texture	Clay loam Clay Clay
10.	pH	5.6 5.4 5.1
11.	CaCO ₃	- - -
12.	Coarse sand	12.0 1.0 -
13.	Fine sand	28.0 11.0 -
14.	Silt	26.0 17.0 -
15.	Clay	31.0 69.0 -
16.	Loss on ignition	26.9 16.8 2.3
17.	Organic carbon	6.48
18.	Nitrogen	0.602
19.	P ₂ O ₅	0.450

1.	Kellogg's tentative name	Red Latosol		
2.	Local soil group name	Red loam		
3.	Location	18 miles north of Atherton		
4.	Parent material or rock	Basalt		
5.	Native vegetation	Rain forest		
6.	Approximate rainfall	50 inches		
7.	Depth	0 - 6	27 - 48	84 - 144
8.	Colour (Teakle)	DRB	DRB	BR
9.	Texture	Clay loam	Clay	Clay
10.	pH	7.1	7.1	7.0
11.	CaCO ₃	-	-	-
12.	Coarse sand	3	3	-
13.	Fine sand	15	9	-
14.	Silt	40	16	-
15.	Clay	38	71	-
16.	Loss on ignition	20.2	11.5	11.6
17.	Organic carbon	-	-	-
18.	Nitrogen	-	-	-
19.	P ₂ O ₅	-	-	-
20.	Exchangeable Ca	-	3.69 (68)	-
21.	Exchangeable Mg	-	1.02 (19)	-
22.	Exchangeable K	-	.59 (11)	-
23.	Exchangeable Na	-	.13 (2)	-
24.	Exchangeable Cations	-	5.43	-

1.	Kellogg's tentative name	Red latosol
2.	Local soil group name	Red loam
3.	Location	18 miles north of Acharon
4.	Parent material or rock	Basalt
5.	Native vegetation	Rain forest
6.	Approximate rainfall	50 inches
7.	Depth	0 - 6 27 - 48 84 - 114
8.	Colour (Munsell)	DRB DRB BR
9.	Texture	Clay loam Clay Clay
10.	pH	7.1 7.1 7.0
11.	CaCO ₃	- - -
12.	Coarse sand	3 3 -
13.	Fine sand	15 9 -
14.	Silt	40 16 -
15.	Clay	38 71 -
16.	Loss on ignition	20.2 11.5 11.6
17.	Organic carbon	- - -
18.	Nitrogen	- - -
19.	P ₂ O ₅	- - -
20.	Exchangeable Ca	- 3.69 (68) -
21.	Exchangeable Mg	- 1.02 (19) -
22.	Exchangeable K	- .59 (11) -
23.	Exchangeable Na	- .13 (2) -
24.	Exchangeable cations	- 5.43 -

1. Kellogg's tentative name		Red Latosol
2. Local soil group name		Red loam
3. Location		2.2 miles north of Atherton
4. Parent material or rock		Basalt
5. Native vegetation		Rain forest
6. Approximate rainfall		50 inches
7. Depth	0 - 6	14 - 28
8. Colour (Teakle)	DRB	DRB
9. Texture	Clay loam	Clay
10. pH	6.6	7.0
11. CaCO_3	-	-
12. Coarse sand	6	4
13. Fine sand	24	18
14. Silt	30	30
15. Clay	30	34
16. Loss on ignition	23.2	12.3
17. Organic carbon	5.97	
18. Nitrogen	0.613	
19. P_2O_5	0.437	
20. Exchangeable Ca	34.36 (84)	7.85 (76)
21. Exchangeable Mg	4.89 (12)	1.66 (16)
22. Exchangeable K	1.41 ($2\frac{1}{2}$)	0.72 (7)
23. Exchangeable Na	0.15 ($\frac{1}{2}$)	0.10 (1)
24. Exchangeable Cations	40.81	10.33

1.	Kelllogg's tentative name	Red latosol
2.	Local soil group name	Red loam
3.	Location	2.2 miles north of Atherton
4.	Parent material or rock	Basalt
5.	Native vegetation	Rain forest
6.	Approximate rainfall	50 inches
7.	Depth	14 - 28
8.	Colour (Munsell)	DRB
9.	Texture	Clay loam
10.	pH	7.0
11.	CaCO ₃	-
12.	Coarse sand	4
13.	Fine sand	18
14.	Silt	30
15.	Clay	34
16.	Loss on ignition	12.3
17.	Organic carbon	2.97
18.	Nitrogen	0.613
19.	P ₂ O ₅	0.137
20.	Exchangeable Ca	34.36 (84)
21.	Exchangeable Mg	4.89 (12)
22.	Exchangeable K	1.41 (2½)
23.	Exchangeable Na	0.15 (½)
24.	Exchangeable Cations	40.81
		10.33

1. Kellogg's tentative name		Red Latosol
2. Local soil group name		Red loam
3. Location	1 mile west of Chewko Crossroad	
4. Parent material or rock		Basalt
5. Native vegetation		Eucalyptus woodland
6. Approximate rainfall		40 inches
7. Depth	0 - 6	19 - 30
8. Colour (Teakle)	DGB	Brt. BR
9. Texture	Clay loam	Clay
10. pH	6.9	6.9
11. CaCO_3	-	-
12. Coarse sand	17	10
13. Fine sand	18	14
14. Silt	26	24
15. Clay	37	49
16. Loss on ignition	10.9	10.1
17. Organic carbon	1.59	-
18. Nitrogen	0.113	-
19. P_2O_5	0.353	-
20. Exchangeable Ca	10.61 (69)	3.45 (59)
21. Exchangeable Mg	3.54 (23)	1.65 (28)
22. Exchangeable K	1.03 (7)	0.58 (10)
23. Exchangeable Na	0.10 (1)	0.16 (3)
24. Exchangeable Cations	15.28	5.84

24. Exchangeable Cations	15.28	5.84
23. Exchangeable Na	0.10 (1)	0.16 (3)
22. Exchangeable K	1.03 (1)	0.58 (10)
21. Exchangeable Mg	3.54 (23)	1.65 (28)
20. Exchangeable Ca	10.61 (89)	3.45 (59)
19. P ₂ O ₅	0.353	-
18. Nitrogen	0.113	-
17. Organic carbon	1.59	-
16. Loss on ignition	10.9	10.1
15. Clay	37	49
14. Silt	26	24
13. Fine sand	18	14
12. Coarse sand	17	10
11. CaCO ₃	-	-
10. pH	6.9	6.9
9. Texture	Clay loam	Clay
8. Color (Munsell)	DGB	B7.5. BR
7. Depth	0 - 6	19 - 30
6. Approximate rainfall		40 inches
5. Native vegetation		Eucalyptus woodland
4. Parent material or rock		Basalt
3. Location		1 mile west of Chewio Crossroad
2. Local soil group name		Red loam
1. Kelllogg's tentative name		Red laterol

1. Kellogg's tentative name	Red Latosol		
2. Local soil group name	Red loam		
3. Location	8.4 miles south of Mareeba		
4. Parent material or rock	Basalt		
5. Native vegetation	Eucalyptus woodland		
6. Approximate rainfall	40 inches		
7. Depth	0 - 6	6 - 18	30 - 41
8. Colour (Teakle)	DRB	BR	R
9. Texture	Clay loam	Clay	Clay loam
10. pH	6.7	6.4	6.3
11. CaCO_3	-	-	-
12. Coarse sand	11	8	-
13. Fine sand	15	8	-
14. Silt	27	16	-
15. Clay	46	66	-
16. Loss on ignition	11.2	10.7	10.7
17. Organic carbon	1.62	-	-
18. Nitrogen	0.114	-	-
19. P_2O_5	0.249	-	-

Near Kellogg's sample No. 4

1.	Kellogg's tentative name	Red loessol
2.	Local soil group name	Red loam
3.	Location	8.4 miles south of Kansas
4.	Parent material or rock	Basalt
5.	Native vegetation	Encalyptus woodland
6.	Approximate rainfall	40 inches
7.	Depth	0 - 6 6 - 18 30 - 41
8.	Colour (Munsell)	DRB BR R
9.	Texture	Clay loam Clay Clay loam
10.	pH	6.7 6.4 6.3
11.	CaCO ₃	- - -
12.	Coarse sand	11 8 -
13.	Fine sand	15 8 -
14.	Silt	27 16 -
15.	Clay	16 66 -
16.	Loss on ignition	11.2 10.7 10.7
17.	Organic carbon	1.62 - -
18.	Nitrogen	0.114 - -
19.	P ₂ O ₅	0.249 - -

Near Kellogg's sample No. 1

1.	Kellogg's tentative name	Yellow Latosol			
2.	Local soil group name	Laterite-yellow			
3.	Location	Junction Mareeba and Chewko Roads <u>a/</u>			
4.	Parent material or rock	Sandstone (?)			
5.	Native vegetation	Eucalyptus woodland			
6.	Approximate rainfall	40 inches			
7.	Depth	0 - 5	14 - 36	48 - 66	66 - 72
8.	Colour (Teakle)	GY	GY	GY,RB,G,B	G,YB,RB
9.	Texture	Gr SCL	VGr SC	Gr SC	C
10.	pH	6.6	6.9	7.2	6.3
11.	CaCO ₃	-	-	-	-
12.	Coarse sand	29	22	22	-
13.	Fine sand	21	10	13	-
14.	Silt	18	16	12	-
15.	Clay	30	48	50	-
16.	Loss on ignition	8.9	10.3	10.7	10.0
17.	Organic Carbon	0.96	-	-	-
18.	Nitrogen	0.077	-	-	-
19.	P ₂ O ₅	0.099	-	-	-
20.	Exchangeable Ca	5.36 (59)	2.63(34)	1.29 (17)	
21.	Exchangeable Mg	3.38(37)	4.64(61)	5.76 (76)	
22.	Exchangeable K	0.22 (3)	0.10(1)	0.10 (1)	
23.	Exchangeable Na	0.10 (1)	0.29(4)	0.45 (6)	
24.	Exchangeable Cations	9.06	7.66	7.60	

a/ Near meeting with settler named Kelley

ATHERTON TABLELANDS (SPECIAL) QUEENSLAND

Black Mt. 3 M.
35

Port Douglas 28 M.
36

37

38

39

24.	Exchangeable Cations	9.06	7.66	7.60
23.	Exchangeable Na	0.10 (1)	0.29 (4)	0.42 (6)
22.	Exchangeable K	0.22 (3)	0.10 (1)	0.10 (1)
21.	Exchangeable Mg	3.38 (37)	11.64 (61)	2.76 (76)
20.	Exchangeable Ca	2.36 (29)	2.63 (34)	1.29 (17)
19.	P ₂ O ₅	0.099	-	-
18.	Nitrogen	0.077	-	-
17.	Organic Carbon	0.96	-	-
16.	Loss on ignition	8.9	10.3	10.7
15.	Clay	30	48	20
14.	Silt	18	16	12
13.	Fine sand	21	10	13
12.	Coarse sand	29	22	-
11.	Gravel	-	-	-
10.	pH	6.6	6.9	7.2
9.	Texture	Gr. SCL	Vgr. SC	Gr. SC
8.	Colour (Testle)	GY	GY	GY, RB, G, B
7.	Depth	0 - 5	14 - 36	48 - 66
6.	Approximate rainfall	110 inches		

a/ Near meeting with settler named Kelley



Concrete or sealed
Metalled or gravelled
or Tracks earthen
Impassable to M.T. in wet weather
Sufficient width for :-
two traffic streams A
one " stream with
occasional passing B
one traffic stream only C
Suitable for :-
heavy M.T. 1
light M.T. (up to 3 ton lorries) 2
horse transport only 3
pack " 4
Note : Brackets denote wet weather
classification B2(C3)
Bridge with load capacity in tons

January 17

I am up at 6:30. It is quiet. At 7:15, the maid brings the morning tea. It is warm and sunny after the rain, and promises to be a fair day. We leave for the field at 8:50, and then waste a half hour with a stop at the office of the Department of Agriculture. Too bad.

We drive south on the smooth, dark red soils that were formerly under the rain forest. Most of the good land is in maize some 3 to 30 inches high. There is some sudan grass and some pasture and weed fallow. There are mountains only 1 to 3 miles on either side of us. On the slopes, there is some sheet wash and a few shallow gullies that could be controlled easily. The amount of pasture increases at 5 miles southeast of Atherton, where we again cross the Barron River. Often there are a few trees or ring-barked stubs in the pastures. The paspalums are prominent in the pastures. As we drive on, the rainfall increases and there are more imperfectly drained soils. At about 8 miles, I should say that dairying, with hay and pasture, was more prominent than maize. There is an increasing amount of woodland -- second-growth rain forest. I see a few sheep.

At 10 miles southeast of Atherton, the country is more rolling. The pastures are mostly paspalum and pennisetum clandestinum (kikuyugrass). Most of the cows are Milking



K-1636 January 16, 1949
Australia. Queensland. 9 miles south of Mareeba.
Thin eucalyptus woodland with kangaroo grass (Themeda australis) on "red loam" (Red Latosol from andesitic basalt?). (Site of sample #4)



K-1637 January 17, 1949
Australia. Queensland. 10 miles southeast of Atherton.
Dairy farm with Milking Shorthorns. Paspalum and some Pennisetum clandestinum.

Shorthorns. There is still some maize. We see some rather deep gullies, possibly accelerating a bit.

We pass through Malanda and go on south toward Millaa Millaa. We are still on the dark red soil of the Atherton Tableland. Most of the land is rolling and in pasture, although there is still a little maize and some woodland.

Gullies are deepening even under the pasture. In the tropics and subtropics, the grasses simply will not hold the soil as well as the trees. As the gullies deepen, slips develop at the margins. Apparently part of the deepening here is a normal process associated with uplift. I see some poor spots in the pasture from grub damage. Flies are bad. In many of the pastures, logs and stumps are lying on the surface as the old ring-barked trees finally tumble.

I stop 2 miles south of Malanda on a rolling hilltop where the slope is about 10 to 15 percent, and the elevation around 2,500 feet. I look first at the soil in a road cut, where the surface has been disturbed and there may have been a little erosion. The underlying rock may be a little harder than normal. Where I look at the soil, a little below the top, there has likely been some colluvial accumulation.

- | | | |
|-------------------|--------------------|---|
| A ₁ -p | 0-5" | Slightly mottled reddish-brown and yellowish-red, coarsely granular clay. |
| A ₃ | 5-24" | Yellowish-red (5YR 4/8) clay. Rather poor blocky structure. Fairly easily friable (but not so much so as Sample No. 5). |
| B (?) | 24-40"
(36-60") | Like the above, but good angular nut structure. Firm in place. Merges into: |
| C | 40-60"+ | Yellowish-red (5YR 5/8), plastic clay. Firm in place and digs out into fairly easily friable subangular nut. In the mass, there are some whitish streaks of weathered chert-like rock material. |

Two hundred yards away, in a patch of second-growth rain forest:

- | | | |
|----------------|-------|---|
| A ₁ | 0-4" | Dark dusky red, with some reddish-black, highly granular clay loam. |
| A ₂ | 4-12" | Dark red clay, easily friable. |
| B | 12" + | Dark red clay, somewhat compact, but digs out in rather easily friable lumps. |

It is said that the basalts are on the andesitic side, which may explain the leaning of the soils toward Red Latosol rather than Reddish-Brown Latosol like those of the Rift Valley or in Hawaii.

(There are certainly many and very persistent flies!)



K-1638 January 17, 1949
Australia. Queensland. 2 miles south of Malanda.
Accelerating gully due partly to recent uplift and
partly to grass where trees should be (not overgrazed).



K-1639 January 17, 1949
Australia. Queensland. $1\frac{1}{2}$ miles south of Tarzali.
Deep cut in side hill showing sharp contact of red
soil, here only 3 to 6 feet deep over andesitic basalt.

We drive on southeast, through mostly strongly rolling upland pasture with stumps and a few trees. One sees very little cropping now, as we cross Ithaca Creek and pass through Tarzali.

South, the country becomes even more rolling -- almost hilly. The dark red soil has a nearly uniform dense turf. Even in deep cuts, I can scarcely see the rocks. A little way south, a cut discloses striking contrasts in the irregular lava and the concentric weathering. A few hill-tops have basaltic boulders. There is some erosion on the steep-sided gullies. It is too bad that these were cleared of trees, because the grass cannot hold against these slips on the Red Latosol. Tree ferns are now conspicuous in the forest.

At some 4 miles beyond Millaa Millaa, the country is still much the same. At 7 miles, we are said to be on the fringe of the "West Palmerston" country, which was opened up sometime after World War I.

We cross the Beatrice River. The road now goes through second-growth rain forest, curiously called "scrub" by the local people. This is not so dense and tall as that in the Congo Basin, but it is still heavy, with many tree ferns and vines. Most of the trees are between 6 inches and 15 inches d.b.h., with a few larger.

We drive on southeast, through mostly strongly rolling upland pasture with stumps and a few trees. One sees very little cropping now, as we cross Itasca Creek and pass through Tazewell.

South, the country becomes even more rolling -- almost hilly. The dark red soil has a nearly uniform dense turf. Even in deep cuts, I can scarcely see the rocks. A little way south, a cut discloses striking contrasts in the irregular lava and the concentric weathering. A few hill-tops have basaltic boulders. There is some erosion on the steep-sided gullies. It is too bad that these were cleared of trees, because the grass cannot hold against these slips on the Red laterals. Tree ferns are now conspicuous in the forest.

At some 4 miles beyond Millis Millis, the country is still much the same. At 7 miles, we are said to be on the fringe of the "West Palmerston" country, which was opened up sometime after World War I.

We cross the Beatrice River. The road now goes through second-growth rain forest, curiously called "scrub" by the local people. This is not so dense and tall as that in the Congo Basin, but it is still heavy, with many tree ferns and vines. Most of the trees are between 6 inches and 12 inches d.b.h., with a few larger.

We drop down in elevation and look at the Red Latosol 16 miles southeast of Millaa Millaa. The country is hilly. Although the solum may be mostly from basalt, there is certainly granite in the lower part. The elevation is 1,700 feet, and the cover is tropical rain forest.

Sample No. 6

- | | | |
|-----------------|---------|--|
| A ₁₀ | 0-2" | Highly granular, very dusky red clay. Many roots. (2.5YR 3/4 - dark reddish-brown) |
| A ₁₁ | 2-6" | Dark red (10R 3/6), softly granular, mellow clay. (2.5YR 4/6 to 3/6 - red to dark red) |
| A ₃ | 6-30" | Dark red (10R 3/6) clay. Slightly firm, weak blocky. Easily friable. (2.5YR 4/6 - red) |
| B ₂ | 30-60" | Red (10R 4/8) clay. Slightly more compact than above, but easily friable. (5YR 7/8 - reddish-yellow) |
| B ₃ | 60-72"+ | Brighter red (10R 5/8) clay, grading into rotten granite. (2.5YR 6/6 - light red) |

A few boulders are scattered through the solum.

We are now in a large area that has not yet been opened for settlement. The soil is good except for its hilliness.

We come down into the East Palmerston country and see bushy pastures with molassas grass, about 23 miles west of Innisfail. The red soils are strongly rolling to hilly. The country has been newly opened. I see lots of wild lantana

along the road and lots of shrub. The country is rather poor and now it is hot.

About 11 miles west of Innisfail, I see some fields of sugarcane. In this part, the cane grub is said to be a serious handicap. There are also pineapples. When first cleared, bananas grow well on this soil, but not after 3 years or so. We have now come to a rainfall of about 150 inches.

We must hurry because of the delays this morning. In road cuts, the soil appears to be relatively granular, dark red clay from basalt. We continue to drive toward the sea. There is now quite a bit of sugarcane on the terraces along the North Johnstone River.

A deep cut 3 or 4 miles west of Innisfail discloses little sign of laterite except for a bit of reticulate mottling in the lower part. The upper soil is mainly dark red, granular clay, with red beneath.

Now, as we drive on, there is nearly solid sugarcane on the brown soils of the old terrace. Near the city, we pass wet swamps of the coastal alluvial plain. The town is built mostly on low, old islands.

We have lunch in Innisfail and drive south over rolling red soil with quite a bit of sheet erosion and some conspicuous slips on the slopes. This erosion could be

controlled very easily, but I am told farmers will not use contouring and strip cropping. There are also many areas of nearly level to gently undulating soil. Sugarcane here is said to yield about 30 tons to the acre in the plant crop and about 25 tons in the ratoons. The cane runs about 15 percent sugar. The farmers use a fairly heavy fertilization for this area, say about 336 lbs. to the acre of a 4-12-6. A side application of ammonium sulphate is made to the crop when last cultivated, both plant and ratoon. Only two ratoon crops are taken here.

We look at the soil 12 miles south, near Mena Creek Falls. This is a red soil from basalt. The color of the B is strictly red (10R 4/8). It has a rather hard blocky structure when dry. There are some irregular, rounded concretions about 1/16 to 1/4 inch in diameter. At some depth, one finds a few spots of semi-hardened laterite. At 10 to 12 feet, it is rotten basalt.

We turn back through Innisfail and drive north. For a way, we drive through nearly solid sugarcane on the brown soils of the terraces and the red soils on the basaltic islands. There is a large coastal-river flood plain here.

Bananas are grown, but I suspect mostly for local use. Here, the Lady Finger dies from the Panama disease, and the Cavendish variety is grown.

controlled very easily, but I am told farmers will not use
contouring and strip cropping. There are also many areas
of nearly level to gently undulating soil. Sugarcane here
is said to yield about 30 tons to the acre in the plant
crop and about 25 tons in the ratoon. The cane runs about
15 percent sugar. The farmers use a fairly heavy fertili-
zation for this area, say about 330 lbs. to the acre of a
4-12-6. A side application of ammonium sulphate is made to
the crop when last cultivated, both plant and ratoon. Only
two ratoon crops are taken here.

We look at the soil 12 miles south, near Mana Creek
Falls. This is a red soil from basalt. The color of the
B is strictly red (10R 4/8). It has a rather hard blocky
structure when dry. There are some irregular, rounded
concretions about 1/2 to 1 1/4 inch in diameter. At some
depth, one finds a few spots of semi-hardened laterite.
At 10 to 12 feet, it is rotten basalt.

We turn back through Inalafali and drive north. For
a way, we drive through nearly solid sugarcane on the brown
soils of the terraces and the red soils on the basaltic
plateaus. There is a large coastal-river flood plain here.
Bananas are grown, but I suspect mostly for local use.
Here, the lady finger dies from the Panama disease, and the
Cavendish variety is grown.

We pass Garrandunga. Here, there is mostly undulating to rolling red soil in sugarcane. I see some cow peas. But 10 miles north of Innisfail, we leave the sugarcane and go into hilly red soil with shrubby pasture and second-growth forest. There is no erosion here. Some of the soils are dark dusky red. At about 12 miles, these are interspersed with soils from schists.

I look hurriedly at a Red Latosol from schists. The red B has some quartz and a few concretions. It is fairly friable. At 5 to 6 feet, it gives way to yellowish-red silty clay, but merges into the rotten schists, with small veins and pockets of quartzite. The whole is mottled with red and a little gray.

This soil looks very much like those from the andesitic basalt and like those from schists near Astrida in Ruanda.

We pass the Russell River onto a nice brown alluvial soil with good sugarcane.

0-15" Strong brown, heavy silt loam. Slightly firm, but very easily friable to mellow crumb. Many roots.

15-30"+ Reddish-brown clay. Firm in place, but digs out as imperfectly blocky, which is easily friable to granular. There are a few small black concretions.

The soil becomes slightly paler in depth.

We pass Garmanganga. Here, there is mostly unaltered
to rolling red soil in sugarcane. I see some cow peas.
But 10 miles north of Imatla, we leave the sugarcane
and go into hilly red soil with shrubby pasture and second-
growth forest. There is no erosion here. Some of the
soils are dark dusky red. At about 12 miles, these are
interspersed with soils from schists.

I look hurriedly at a Red latosol from schists. The
red B has some quartz and a few concretions. It is fairly
friable. At 5 to 6 feet, it gives way to yellowish-red
silty clay, but merges into the rotten schists, with small
veins and pockets of quartzite. The whole is mottled with
red and a little gray.

This soil looks very much like those from the andesitic
basalt and like those from schists near Astrid in Randa.
We pass the Russell River onto a nice brown alluvial
soil with good sugarcane.

0-15" Strong brown, heavy silt loam.
Slightly firm, but very easily friable
to mellow crumb. Many roots.
15-30" Reddish-brown clay. Firm in place,
but digs out as imperfectly blocky,
which is easily friable to granular.
There are a few small black concretions.

The soil becomes slightly paler in depth.

We pass Pawngilly and Miriwinni. Here there are gray-brown soils and a slightly higher terrace with good-looking sugarcane. The soils are said to be a bit too wet in the wet season, and a bit too dry in the dry season. Sugarcane extends for a long ways toward the sea, but to the left are high, rugged, forested soils. As we drive along, I see some red soils on old islands of schists sticking through the terraces. We pass Babinda, where the rainfall is 180 inches.^{3*} The name of this town is the native word for "place of rain." A little further north are beautiful, rugged, forested mountains up to 5,000 feet. I stop to look hurriedly at an alluvial soil 7 miles north of Miriwinni.

- | | | |
|---|-----------|---|
| A | 0-15"(24) | Yellowish-brown, fine sandy loam. Firm, but easily friable. Pink-gray when dry. |
| D | 24" + | Gray, white, and yellow, loose, fine granitic gravel and sand, stratified. |

At about 2 miles, there are more reddish-brown soils on better-drained terraces, used mostly for sugarcane. There are also a few patches of gray soils from colluvial granitic materials -- materials that have accumulated on the foot slopes of the mountains.

Further north, there is more schist material in some of the terraces. Sugarcane is grown on these and on some

We pass Pampally and Mirivani. Here there are gray-brown soils and a slightly higher terrace with good looking sugarcane. The soils are said to be a bit too wet in the wet season, and a bit too dry in the dry season. Sugarcane extends for a long ways toward the sea, but the left are high, rugged, forested soils. As we drive along, I see some red soils on old islands of schists striking through the terraces. We pass Badinda, where the rainfall is 180 inches. ^{3*} The name of this town is the native word for "place of rain." A little further north are beautiful, rugged, forested mountains up to 5,000 feet. I stop to look hurriedly at an alluvial soil 7 miles north of Mirivani.

A	0-15" (24)	Yellowish-brown, fine sandy loam. Firm, but easily friable. Pink-gray when dry.
B	24" +	Gray, white, and yellow, loose, fine granitic gravel and sand, stratified.

At about 2 miles, there are more reddish-brown soils on better-drained terraces, used mostly for sugarcane. There are also a few patches of gray soils from colluvial granitic materials -- materials that have accumulated on the foot slopes of the mountains. Further north, there is more schist material in some of the terraces. Sugarcane is grown on these and on some

nearly black soils developed under a swamp forest. I see one that is nearly a Half-Bog.

Part of these upper terraces appear to be strath terraces on schist rocks. We drive for some miles along one of these with younger alluvial soils at a slightly lower level. Both terraces are used for sugarcane in rather large fields. soil types is indeed complex.

We cross the Mulgrave River and come to Gordonvale. Just north, we pass over some poor, rather wet, heavy, gray alluvial soils. A little further are local brown terraces from basaltic materials. The soils are used for cane. They also do some fertilizer work and variety testing.

We stop at the Northern Experiment Station at Meringa, Mr. G. Bates, Director. It wasn't quite so hot today as it seemed; the thermometer at the Station registers 96° F. Mr. Bates showed me a soil map that he was making of the district. His classification is about as follows:

(1) Alluvial soils

- (a) Schist alluvium as very tired. Still we must have
- (b) Granitic alluvium 1st delays, we leave at 5:30 p.m.
- (c) Mixed alluvium it as we pass the edge of

(2) Schist soils - Water Pooled in a cut along the road.

(a) Red

(b) Brown

(c) Gray, with heavy clay 1/

1/ Possibly planosolic.

nearly black soils developed under a swamp forest. I
 see one that is nearly a Half-Bog.
 Part of these upper terraces appear to be stratified
 terraces on schist rocks. We drive for some miles along
 one of these with younger alluvial soils at a slightly
 lower level. Both terraces are used for sugarcane in
 rather large fields.
 We cross the Mulgrave River and come to Gordonvale.
 Just north, we pass over some poor, rather wet, heavy,
 gray alluvial soils. A little farther are local brown
 terraces from basaltic materials. The soils are used for
 cane.
 We stop at the Northern Experiment Station at Herings,
 Mr. G. Bates, Director. It wasn't quite so hot today as
 it seemed; the thermometer at the station registers 90° F.
 Mr. Bates showed me a soil map that he was making of the
 district. His classification is about as follows:
 (1) Alluvial soils
 (a) Schist alluvium
 (b) Granitic alluvium
 (c) Mixed alluvium
 (2) Schist soils
 (a) Red
 (b) Brown
 (c) Gray, with heavy clay
 Possibly planosollic.

(3) Granitic soils

(a) Gravel

(b) Clayey gravel

(4) Volcanic soils, mostly red

Some of these are probably developed on strath terraces as well as colluvial slopes and local alluvium. The pattern of local soil types is indeed complex.

Although a soil geneticist might not think much of this map, I suspect it is reasonably reliable in indicating the local differences.

On this station, they are dealing mostly with breeding cane. They also do some fertilizer work and variety testing on the farms.

Mr. Bates says that the volcanic soils need much potassium and little phosphorus; the granitic soils need much phosphorus and little potassium; and the schist soils need both phosphorus and potassium; and all the soils need nitrogen for sugarcane.

Now it is very late and I am very tired. Still we must have tea! After many "social" delays, we leave at 6:40 p.m. It is dusk, but just as we pass the edge of Cairns, I see a Ground-Water Podzol in a cut along the road.

(3) Granitic soils

(a) Gravel

(b) Clayey gravel

(4) Volcanic soils, mostly red

Some of these are probably developed on strata terraces as well as colluvial slopes and local alluvium. The pattern of local soil types is indeed complex.

Although a soil genetist might not think much of this map, I suspect it is reasonably reliable in indicating the local differences.

On this station, they are dealing mostly with breeding cane. They also do some fertilizer work and variety testing on the farms.

Mr. Bates says that the volcanic soils need much potassium and little phosphorus; the granitic soils need much phosphorus and little potassium; and the schist soils need both phosphorus and potassium; and all the soils need nitrogen for sugarcane.

Now it is very late and I am very tired. Still we must have tea! After many "social" delays, we leave at 6:40 p.m. It is dusk, but just as we pass the edge of Cairns, I see a Ground-Water Pothole in a cut along the road.

We are back at the hotel at 7:00, and here is a reporter waiting for me, but I must make a quick change to get into the dining room at 7:30.

After dinner, I have a talk with the reporter for the local morning paper, and rest a bit before bed.

This has been an interesting day, but far too long.

at 7:25, and it is already sunny and hot. As we fly south, I notice a large irregular area of swampy flood plain between the terraces I saw yesterday used for sugarcane, and the sea. Much of the area on the sloping red soils looks thin and poor -- probably too little moisture.

I unfold my newspaper. Last night I told the reporter, among other things, that more fundamental research was needed in the tropics rather than more testing stations. But he quotes me as advocating more testing stations.

Near Cardwell there is only a little cleared land. We turn over Halifax Bay toward Townsville. I look at Fremont's map. The area shown as podzols seems to be a sort of "catch-all." The areas I have seen include Planchon's, Lithomels, Lithomels Red Latosols, Lithomels Sellow Latosols, Lithomels, Red Latosols, Red-Yellow Podzols, alluvials, and Gravel-Water Pedals -- but no Podzols.

We stop at Townsville, and get away again at 7:20. We finally are back at Brisbane at 7:40 P.M.

January 18

Mr. Hubble, Professor Teakle, and I leave the hotel at 7:00, weigh in at the air station, and go to the airport.

As I leave the hotel, I am given a small purse made from a bladey grass (Imperata cylindrica) by Lottie Maywee, an elderly aboriginal. We are in the plane at 7:25, and it is already sunny and hot. As we fly south, I notice a large irregular area of swampy flood plain between the terraces I saw yesterday used for sugarcane, and the sea. Much of the cane on the sloping red soils looks thin and poor -- probably too little moisture.

I unfold my newspaper. Last night I told the reporter, among other things, that more fundamental research was needed in the tropics rather than more testing stations. But he quotes me as advocating more testing stations!

Below Cardwell there is only a little cleared land. We turn over Halifax Bay toward Townsville. I look at Prescott's map. The area shown as podzols seems to be a sort of "catch-all." The areas I have seen include Planosols, Lithosols, lithosolic Red Latosols, lithosolic Yellow Latosols, Wiesenboden, Red Latosols, Red-Yellow Podzolic, alluvials, and Ground-Water Podzol -- but no Podzol.

We stop at Townsville, and get away again at 9:20. We finally are down at Brisbane at 2:40 p.m.

January 18

Mr. Hubble, Professor Taskie, and I leave the hotel at 7:00, weigh in at the air station, and go to the airport. As I leave the hotel, I am given a small purse made from a bladey grass (Imperata cylindrica) by Lottie Maywee, an elderly aboriginal. We are in the plane at 7:25, and it is already sunny and hot. As we fly south, I notice a large irregular area of swampy flood plain between the terraces I saw yesterday used for sugarcane, and the sea. Much of the cane on the sloping red soils looks thin and poor -- probably too little moisture. I unfold my newspaper. Last night I told the reporter among other things, that more fundamental research was needed in the tropics rather than more testing stations. But he quotes me as advocating more testing stations! Below Gardwell there is only a little cleared land. We turn over Halifax Bay toward Townsville. I look at Prescott's map. The area shown as podzols seems to be a sort of "catch-all." The areas I have seen include Planosols, Lithosols, Lithosolic Red Latosols, Lithosolic Yellow Latosols, Wiesenboden, Red Latosols, Red-Yellow Podzolic, alluvials, and Ground-Water Podzol -- but no Podzol. We stop at Townsville, and get away again at 9:20. We finally are down at Brisbane at 2:40 p.m.

As soon as I am back to the Lennons Hotel, a reporter calls on me, and after dinner, two more! I talk with them about the world food problem, the need for fundamental research in the tropics, and the importance of erosion-control practices in the Atherton Tableland before it is too late.

Shortly after 7:00 p.m., Mr. Hubble calls for me and I go to the University and address a group of perhaps 50 agriculturists of the State Department of Agriculture, the University, and the CSIR, according to the following outline:

- I. Problems of agriculture
 - A. Production
 - B. Conservation
 - C. Living standards
 - D. Full employment
- II. Full use of our soils on a sustained basis
- III. What is soil?
 - A. Depth and area
 - B. Genetic factors
 - C. Landscape
- IV. Soil classification units as bases for predictions
 - A. Classification depends upon knowledge -- all scientific results and experience

As soon as I am back to the Lannons Hotel, a reporter calls on me, and after dinner, two more! I talk with them about the world food problem, the need for fundamental research in the tropics, and the importance of erosion-control practices in the Amazon Tableland before it is too late.

Shortly after 7:00 p.m., Mr. Hubble calls for me and I go to the University and address a group of perhaps 50 agriculturists of the State Department of Agriculture, the University, and the CSIR, according to the following

outline:

- I. Problems of agriculture
 - A. Production
 - B. Conservation
 - C. Living standards
 - D. Full employment
- II. Full use of our soils on a sustained basis
- III. What is soil?
 - A. Depth and area
 - B. Genetic factors
 - C. Landscapes
- IV. Soil classification waits as bases for predictions
 - A. Classification depends upon knowledge -- all scientific results and experience

January B. Experimental research

I go up 1. Laboratory before breakfast. This is such

a nice room. 2. Field bit to leave it. Then too, I have

had a good C. Scientific correlation island. Mr. Hobbie

and Prof D. Analyses of existing experience and helpful.

I go to E. Productivity ratings to the airport (with

reporters in 1. Yield I am in the air out of Brisbane

at 10:15 a.m. 2. Management practices the "podzol," there

are only a 3. Long-time productivity main roads. The

land is such (Emphasize the importance of the ceiling of

land is large responsive soils.) a few trees. There are

very V. Extending predictions and soil maps of it is gently

roll VI. Detail of soil surveys mountains, mostly rounded.

At A. Categorical too, the land is even more hilly

and the B. Cartographic than this forest and pasture again.

Now C. Need for accuracy very irregular topography,

the VII. Cooperation and choppy, with a larger part in

VIII. Progress of knowledge about soil management small

clearing A. Fundamental research

We B. Applied research have leave again at 2:00 p.m.

We are C. Pilot research farms forested land. (The

place is D. Demonstration farms valley about 35° South

latitude E. Farm planning service open land used for crops,

with I go back to the hotel about 10:00 with a very sore

back. Apparently airplane riding hurts it more than car riding.

January 19

I am up early and pack before breakfast. This is such a nice room, I regret a bit to leave it. Then too, I have had a most interesting visit in Queensland. Mr. Hubble and Professor Teakle have been most courteous and helpful. I go to the air station and by bus to the airport (with reporters in each place!). I am in the air out of Brisbane at 10:15 a.m. South of Brisbane, on the "podsol," there are only a few cleared places along the main roads. The land is mostly thin woodland. About 35 miles out, the land is largely grass with only a few trees. There are many black patches from recent burns. Most of it is gently rolling to hilly, with some low mountains, mostly rounded.

At about 70 or 80 miles, the land is even more hilly and the forest heavier; then thin forest and pasture again.

North of Sydney, along the very irregular shoreline, the country is rolling and choppy, with a larger part in forest. Red soil shows up in the roads and in a few small clearings.

We stop in Sydney, and then leave again at 2:00 p.m. We are soon over choppy, rolling, forested land. (The plane is very rough.) In a river valley about 35° South latitude, there is quite a bit of open land used for crops, with rather heavy forests on the steeply sloping ridges.

January 19

I am up early and pack before breakfast. This is such a nice room, I regret a bit to leave it. Then too, I have had a most interesting visit in Queensland. Mr. Hubble and Professor Tieske have been most courteous and helpful. I go to the air station and by bus to the airport (with reporters in each place!). I am in the air out of Brisbane at 10:15 a.m. South of Brisbane, on the "podsol," there are only a few cleared places along the main roads. The land is mostly thin woodland. About 35 miles out, the land is largely grass with only a few trees. There are many black patches from recent burns. Most of it is gently rolling to hilly, with some low mountains, mostly rounded. At about 70 or 80 miles, the land is even more hilly and the forest heavier; then thin forest and pasture again. North of Sydney, along the very irregular shoreline, the country is rolling and choppy, with a larger part in forest. Red soil shows up in the roads and in a few small clearings. We stop in Sydney, and then leave again at 2:00 p.m. We are soon over choppy, rolling, forested land. (The plane is very rough.) In a river valley about 35° South latitude, there is quite a bit of open land used for crops, with rather heavy forests on the steeply sloping ridges.

Fallow fields indicate reddish-brown soils. As we go on toward Canberra, the proportion of arable land diminishes, and most of the soil is yellowish-brown, although part is reddish-brown. Beyond Tarago, the land appears to be quite dry and fairly open, with only a few cultivated fields. There are forests on the tops of the ridges. (All shown on Prescott's map as "podzols"!!!)

We pass over Lake George -- an intermittent lake, with shallow water in the lowest part. Between the water and the shore, the land appears to be marked out in huge rectangles. This puzzles me.^{4*/}The country beyond is rolling to hilly. Mostly, the forest is very thin. The few clear fields are likely irrigated.^{5*/}This thinly wooded grassland now looks brown and dry. There are bolder hills to the south and west with forest cover.

We are down at Canberra at 3:08 p.m. This town sets out in the sun, hot and dry, like I remember Athens. As we come down, the soils appear to be brown.^{6*/}On the ground it is warm, not quite hot. The flies are plentiful and persistent, like those in Cairo. There is nothing here to be seen that suggests Podzols. One could easily imagine himself on the dry side of the Coast Range in California or in eastern Kansas on a hot summer day.



RBN
SCHOFIELDS
340 SF

BS
2LF
1340

RBN
YASS
290 YS

RBN
CANBERRA
215 CB

CANBERRA
1850 LH 68
CANBERRA TOWER
4495 116.1mc

CS-OF
CANBERRA RADIO
325 VZCB

INDEX

12 *Couberro*

TOPOGRAPHICAL SYMBOLS

CITIES and TOWNS

HIGHWAYS and

CONTROL or Marine Beacon.

R Bn
EVERETT
224 MMC

CS
GOWEN AIRWAYS
4220

CS
KAZAN
5200 WYZW

BS
WOL
1260

- Metropolitan Areas ----- NEW YORK
- Large Cities ----- RICHMOND
- Cities ----- ARLINGTON
- Small Cities ----- SANGATE
- Large Towns ----- Corville
- Towns & Villages ----- Arcola

- Dual Lane Highways -----
- Primary Roads -----
- Secondary Roads -----
- Trails -----
- U. S. Road Markers -----
- National, State or Provincial Road Markers -----
- Road Names -----

RELIEF FEATURES

FIXES

CASE INTERSECTION

ANT SECTION

Contours { Reliable -----
Depression -----
Approximate -----

Bluffs, Cliffs & Escarpments -----

Sand { Dunes -----
Areas -----
Ridges -----

HYDROGRAPHIC FEATURES

Nautical Miles

ER 7

5000

270°

4000

the Uncontrolled

AL)

(Blue) B

270°

(Yellow) Y

- Swamps & Marshes -----
- Mud & Tidal Flats -----
(Exposed at low tide)
- Fathom Line (Dots uniformly spaced) -----
(1 fathom, 6 ft. below mean low water level)
- Danger Line (Dots grouped in pairs) -----
(2 fathoms, 12 ft. below mean low water level)
- Charted Rocks -----
- Shoals, Sand Bars, etc. -----
(Exposed at low tide)
- Springs -----
- Wells & Water Holes -----
- Reefs, Coral & Rocky Ledges -----
(Awash at low tide)



- Streams & Rivers { Perennial -----
Intermittent -----
Probable or Unsounded -----
Braided -----
- Intermittent Lakes -----
- Drainage Ditches -----
- Canals { In use -----
Abandoned -----
- Flood Marked Areas -----
- Sand Deposits in river bed -----
- Dry Washes -----
- Glaciers -----

CULTURAL and MISCELLANEOUS

Power Transmission Lines -----

Telephone & Telegraph Lines -----

Dams -----

Elevations { Highest in a general area -----
(Highest on chart is devoid of tint)
Spot -----

• 5287

• 4291

- Boundaries { International -----
State & Provincial -----
- *The same as International symbol on old
- Abandoned or Under Construction -----
- Single Track -----
- Double Track -----
- Railroads -----

RANGE

B

245°

Y

We are in the air for Corowa at 3:35. We pass over rolling to hilly grassland with scattered trees. I see a few fields and some patches of woods. About 25 miles out, the country is more rough. The mountains to the south are nearly completely forested. We pass over the very northern tip of this range near Wee Jasper, where miles to the north I see rolling to hilly brown grassland with scattered trees. The forests on the mountains look nearly black. On the whole, one gets an impression of nearly desolate, unproductive country. Here and there I see a few forest plantings.

(I now discover that no lunch is served on this flight from Brisbane to Melbourne, despite its excellent description in the timetable).

Here and there I see a few fields, and suspect that part of them, at least, are locally irrigated.^{5*} North and east of Albury, the relief is less bold and I see more fields and more rural homes. The cultivated soil seems to be yellowish-brown. Directly north of Albury, the comparatively smooth land seems to be brown, dark brown, or grayish-brown, with about 75 percent of the area in fields. Perhaps one-fourth of these are in fallow. This seems to be fairly thickly settled country. I suspect that the main crop is wheat.

We are in the air for Corowa at 3:35. We pass over

rolling to hilly grassland with scattered trees. I see

a few fields and some patches of woods. About 25 miles

out, the country is more rough. The mountains to the south

are nearly completely forested. We pass over the very

northern tip of this range near Waa Jasper, where miles

to the north I see rolling to hilly brown grassland with

scattered trees. The forests on the mountains look nearly

black. On the whole, one gets an impression of nearly

barren, unproductive country. Here and there I see a

few forest plantings.

(I now discover that no lunch is served on this flight

from Brisbane to Melbourne, despite the excellent description

in the timetable).

Here and there I see a few fields, and suspect that

part of them, at least, are locally irrigated. North and

east of Albany, the relief is less bold and I see more fields

and more rural homes. The cultivated soil seems to be

yellowish-brown. Directly north of Albany, the comparatively

smooth land seems to be brown, dark brown, or grayish-brown,

with about 75 percent of the area in fields. Perhaps one-

fourth of these are in fallow. This seems to be fairly

thickly settled country. I suspect that the main crop is

wheat.

We drop down for a few minutes at Corowa. Probably this area once had many more trees, judging by those concentrated in the fence rows. The land is dry and the grass yellow. The soil is heavy -- nearly planosolic. At this stop there is only a field -- no shelter or station. We are in the air for Melbourne at 5:06.

We pass over the Ovens River, with wooded first bottoms. As far as I can see to the west and southwest, the land is nearly level to gently undulating. I should say that roughly one-third of this is plowable, and of that, one-fourth is in fallow. The remainder is mainly grassland with a few scattered trees.

East of the Waranga Reservoir, the land is much the same. To the east of the plane, however, the country is hilly grassland with a few patches of forest. The far distant mountains have heavy forests.

Near Euroa, there is less arable land. Some 20 miles or so north of Seymour, the land becomes more rolling with some steep slopes. As we approach Melbourne, the amount of arable land seems to increase. Part of this appears to be used for dairy farms.

We are down at Melbourne at 6:06 p.m. I have a long wait for my baggage, which makes me think of Washington. I am met at the airport by a driver from the CSIR, who

We drop down for a few minutes at Corowa. Probably

this area once had many more trees, judging by those

concentrated in the fence rows. The land is dry and the

grass yellow. The soil is heavy -- nearly planosolic. At

this stop there is only a field -- no shelter or station.

We are in the air for Melbourne at 5:00.

We pass over the Yarra River, with wooded first

bottoms. As far as I can see to the west and southwest,

the land is nearly level to gently undulating. I should

say that roughly one-third of this is plowable, and of that,

one-fourth is in fallow. The remainder is mainly grassland

with a few scattered trees.

East of the Waranga Reservoir, the land is much the

same. To the east of the plane, however, the country is

hilly grassland with a few patches of forest. The far

east mountains have heavy forests.

Near Etnos, there is less arable land. Some 50 miles

or so north of Seymour, the land becomes more rolling with

some steep slopes. As we approach Melbourne, the amount of

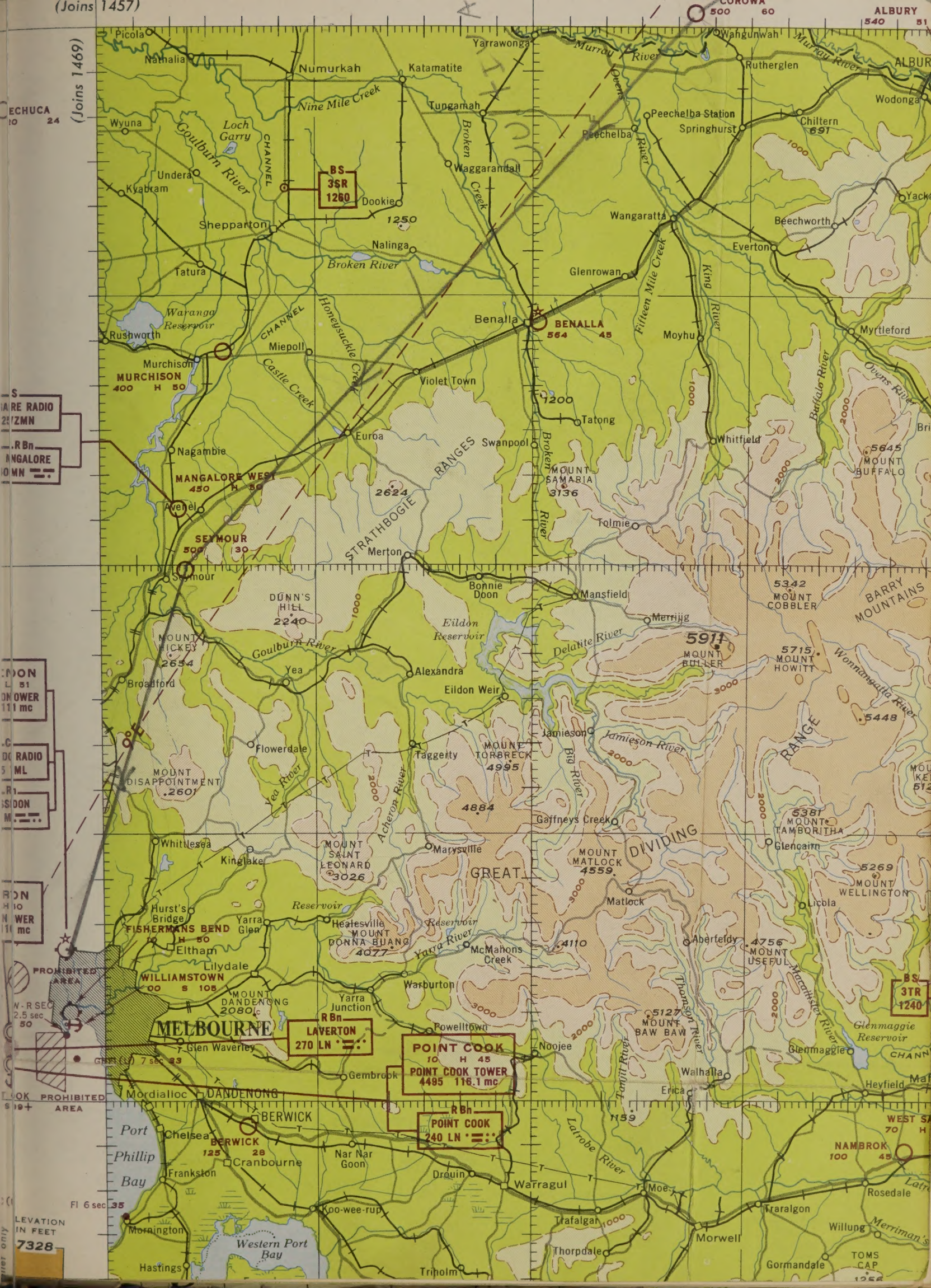
arable land seems to increase. Part of this appears to be

used for dairy farms.

We are down at Melbourne at 6:00 p.m. I have a long

wait for my baggage, which makes me think of Washington.

I am met at the airport by a driver from the CEIR, who



CHUCA
10 24

(Joins 1469)

S
ARE RADIO
21/2MN
R Bn
MANGALORE
OWN

ON
L 51
ON POWER
111 mc
C
RADIO
5 ML
R
SDON
M

ON
H 10
N POWER
111 mc

PROHIBITED
AREA
W-R SEC
2.5 sec
50
GPR (U) 7 sec 23
LOOK PROHIBITED
50+
AREA

LEVATION
IN FEET
7328
net only

BS
3SR
1260

BENALLA
564 45

MANGALORE WEST
450 H 50

SEYMOUR
500 30

DUNN'S HILL
2240

MOUNT
HICKEY
2654

MOUNT
DISAPPOINTMENT
2601

MOUNT
SAINT
LEONARD
3026

MOUNT
DONNA BUANG
4077

MELBOURNE

LAVERTON
270 LN

POINT COOK
10 H 45
POINT COOK TOWER
4495 116.1 mc

POINT COOK
240 LN

MOUNT
MATLOCK
4559

5911
MOUNT
BULLER

5342
MOUNT
COBBLER

5715
MOUNT
HOWITT

5381
MOUNT
TAMBORITHA

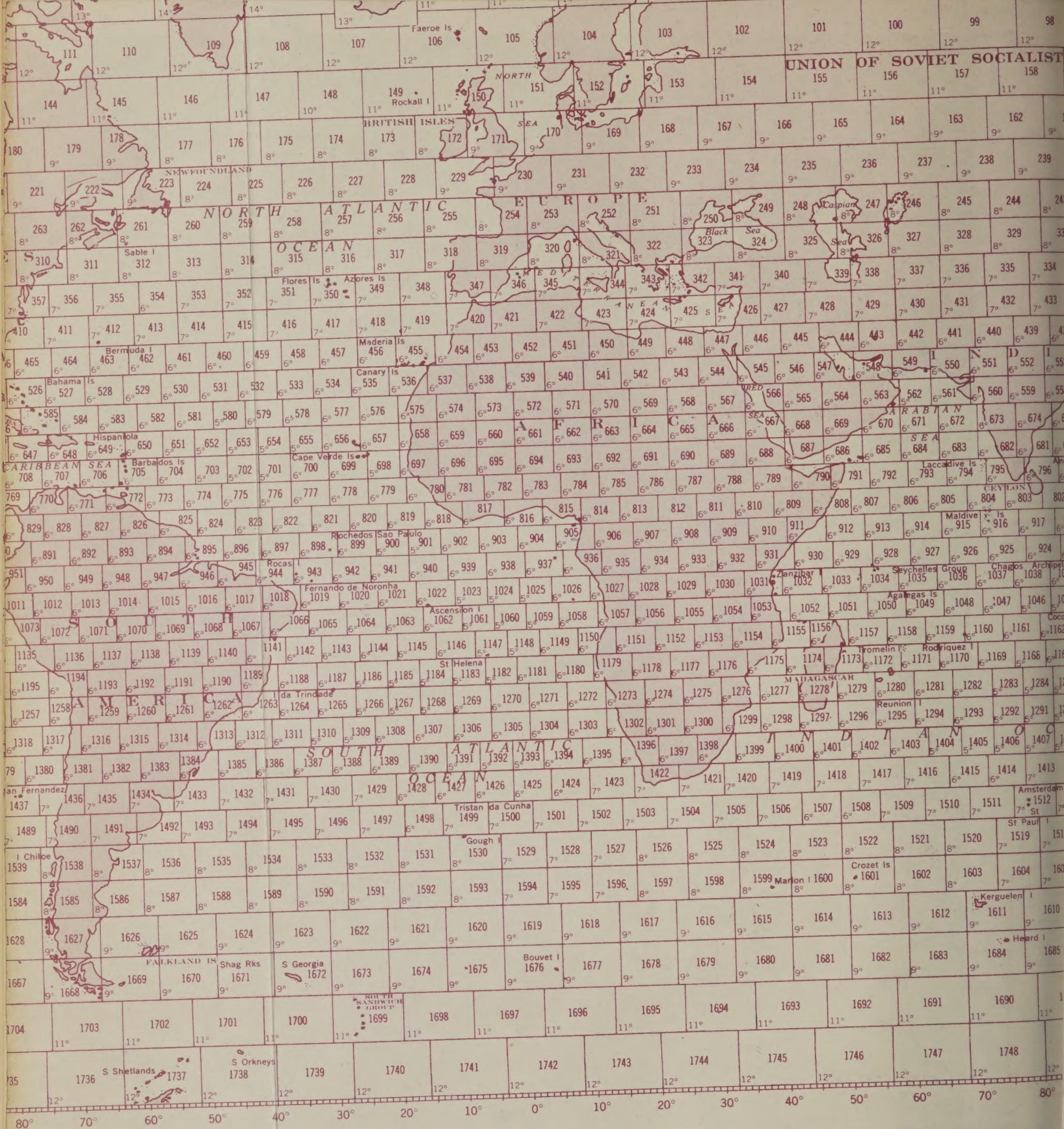
5269
MOUNT
WELLINGTON

BS
3TR
1240

NAMBROK
100 45

WEST SA
70 H

TOMS
CAP
1254



INDEX

(13) Melbourne

TOPOGRAPHICAL SYMBOLS

CITIES and TOWNS

Metropolitan Areas ----- NEW YORK

Large Cities ----- RICHMOND

Cities ----- ARLINGTON

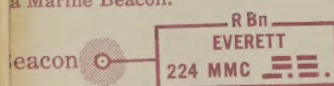
HIGHWAYS and

Dual Lane Highways -----

Primary Roads -----

Secondary Roads -----

S. CONTROL or
a Marine Beacon.



C.S.

takes me to the Alexander Hotel, where I have a comfortable room. I have dinner and a pleasant chat afterward with Mr. N. A. Whiffen, until very recently Scientific Liaison Officer with the Australian Embassy in Washington. Then, early to bed after a very long day.

(Joins 1458) (Joins 1457)

(Joins 1457)

1440



Requisitions thru the supply channels designated by the theater and distribution of aeronautical charts and maps. Submit requisitions for replenishment of stocks of aeronautical charts and maps to Headquarters, Aeronautical Chart Service, AAF,

Requisitions from AAF activities within Continental United States are to be made as indicated in AAF Aeronautical Chart Catalog. Except when made at Headquarters, requisitions are to bear the signature or approval by the Officer. Quantities of charts and maps requested are to be such as to provide a 60-day supply. (Clearing stations authorized to make requisitions direct to the appropriate aeronautical chart store).

Maps and Charts.

For specific missions, and also those maps and charts published by other than the principal types of aeronautical charts, in the current edition of the "Aeronautical Publications", should be requisitioned from Headquarters, Aeronautical Chart Service, AAF, if available, when sufficiently identified in requisitions as to title, scale, and edition. Action of certain selected aeronautical charts and maps may be obtained from Headquarters, Aeronautical Chart Service, AAF.

When a chart is replaced by a new edition, when not practicable to correct for conformity with the old edition, or else destroyed. Disposition by salvage or destruction is to be made in accordance with the instructions of the Department of Commerce, Washington 25, D.C., is responsible for the disposal of charts and maps required for civilian use. Inquiries from United States civilians regarding charts and maps should be submitted direct to that agency.

FOLD HERE TO RETURN TO HQRS., ACS.

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, \$3.00

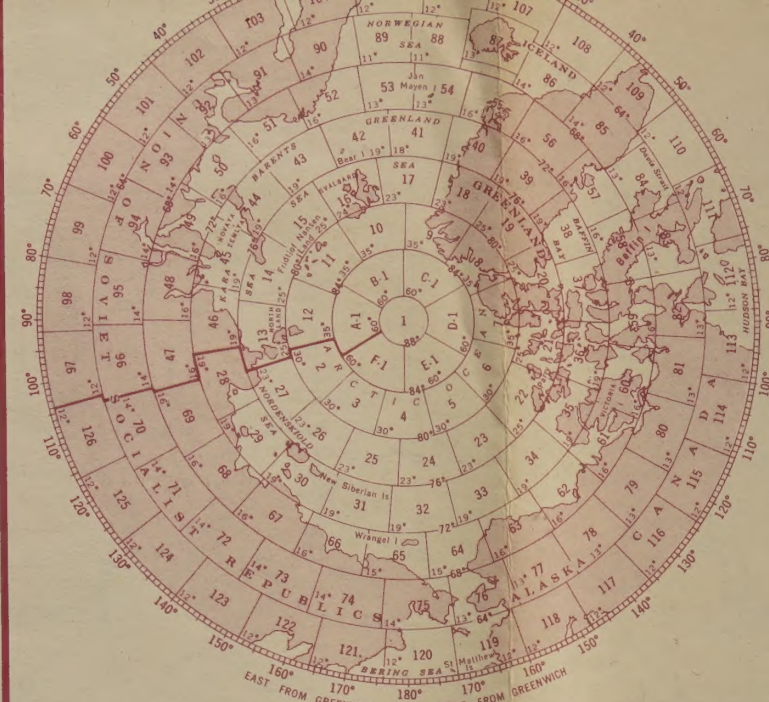
(14) West from Melbourne (1:1)

g Officer
Aeronautical Chart Service, AAF
25, D. C.

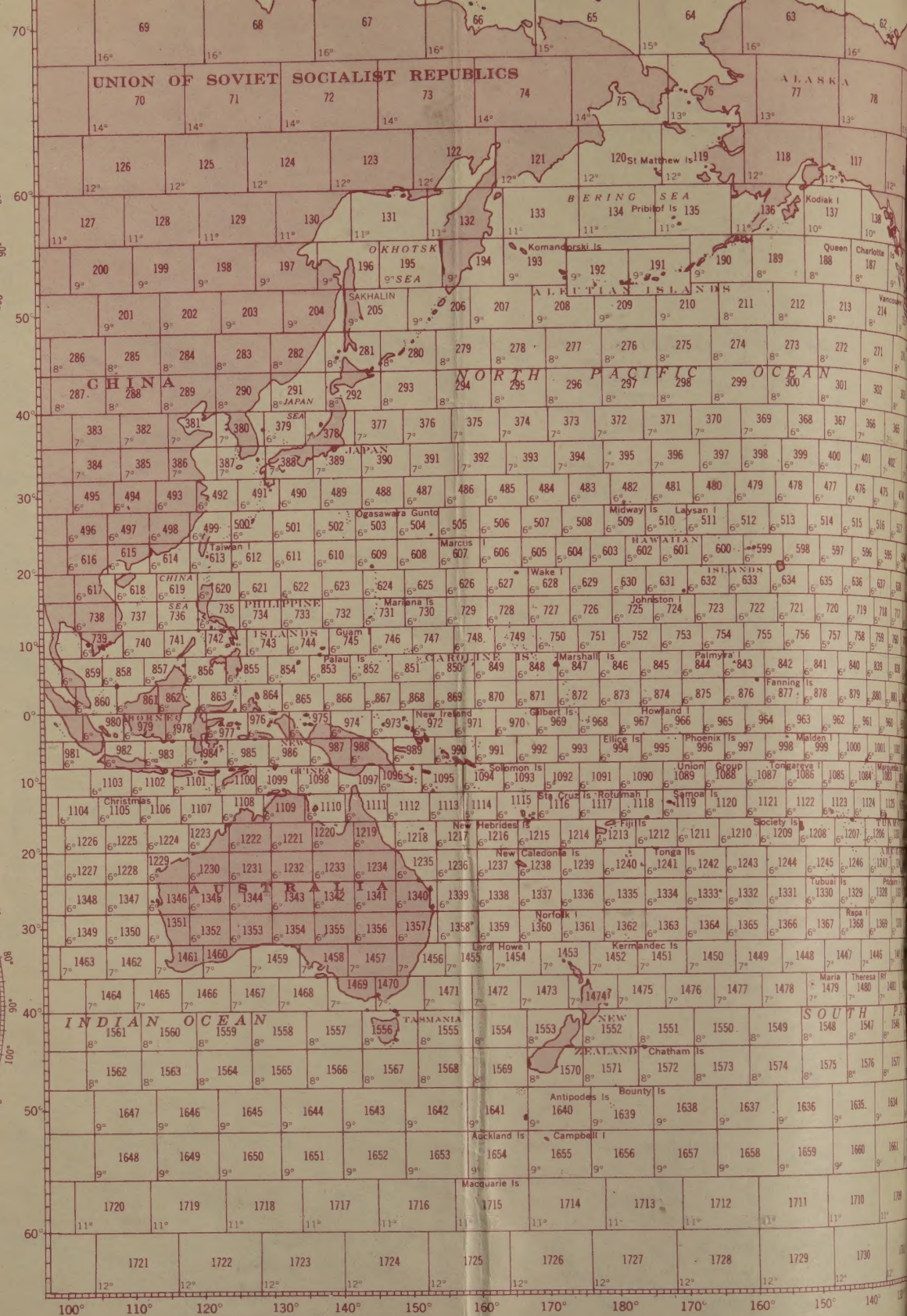
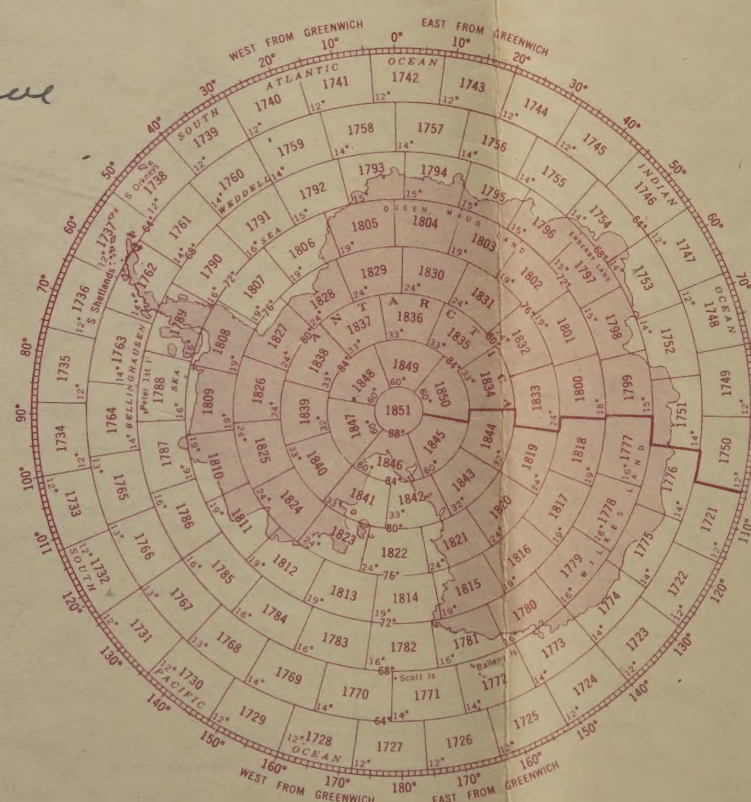
STAPLE HERE

STAPLE HERE

INSTRUCTIONS



SOUTH POLAR AREA



WORLD AERONAUTICAL CHART
Scale of 1:1,000,000

AERONAUTICAL SYMBOLS

AIRCRAFT FACILITIES

AERONAUTICAL CHART

January 20

I am up, as usual, at 6:15 and, to my dismay, find that this hotel does not serve morning tea, and the dining room doesn't open until 7:30!

Driving in from the airport last evening, Melbourne seemed to be quite a nice city, with clean, broad streets. It looks more English than Brisbane.

About 9:00 I check out of the hotel and go to the air station. They had just told me on the phone that everything was in order, but when I get to the air station, I find that the plane is very late. I go by bus to the airport, and at 11:30 get on one of the very large planes of the British Lines. Although it was cool last night, it is very hot now. About 15 miles out, the soils are red. A large percentage are cultivated, and perhaps one-fourth of this is in fallow. Variations in color suggest considerable sheet erosion. Even in the non-arable pasture, one sees only a few trees.

About 35 miles out, the land is dry and rougher -- dissected uplands with patches of forests. The soil appears to be dark gray, light gray, and brown. Then at 50 miles or so, I see rolling brown soil, perhaps one-third arable, with a few patches of forests. This continues beyond Mount Avoca; then we fly over an area of somewhat more



PROHIBITED AREA

PORT ADELAIDE
00 S 180

PORT ADELAIDE
Outer Harbour

BS 5CL 730

PARAFIELD
60 L 76
PARAFIELD TOWER
365

CS
PARAFIELD
325 VZAD

RBN
PARAFIELD
365 AD

ALDINGA BAY

Normanville

Rapid Head

Cape Jervis

Gp FI (U) 20 sec 76

Yatala Shoal

Cape St Albans

Gp FI 15 sec 253

Cape Hart

Antechamber Bay

Willson Bay

Eastern Cape

Penneshaw

Backstairs Passage

The Pages

Encounter Bay

Newland Head

Victor Harbor

Goolwa

Hindmarsh Island

Ewe Island

Point Sturt

Point McLeay

Ashville

Meningie

Magrath Flat

Coonalpyn

Tintinara

Geranium

Marama

Wirra

301

344 Pinnaroo

Lameroo

Quondong Bore

Box Flat (Homestead)

Burn Springs Bore

360

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

35°

CORRECTION INSTRUCTIONS

Chart are urged to mark hereon any errors or omissions. Corrections of radio and airway features (roads, canals, power lines, etc.) should be marked on the face of the chart or by writing elevation corrections, state method used by observer in making the determination, made to furnish the user with accurate charts. The user will materially assist in this

on face of chart or under remarks on back of chart.

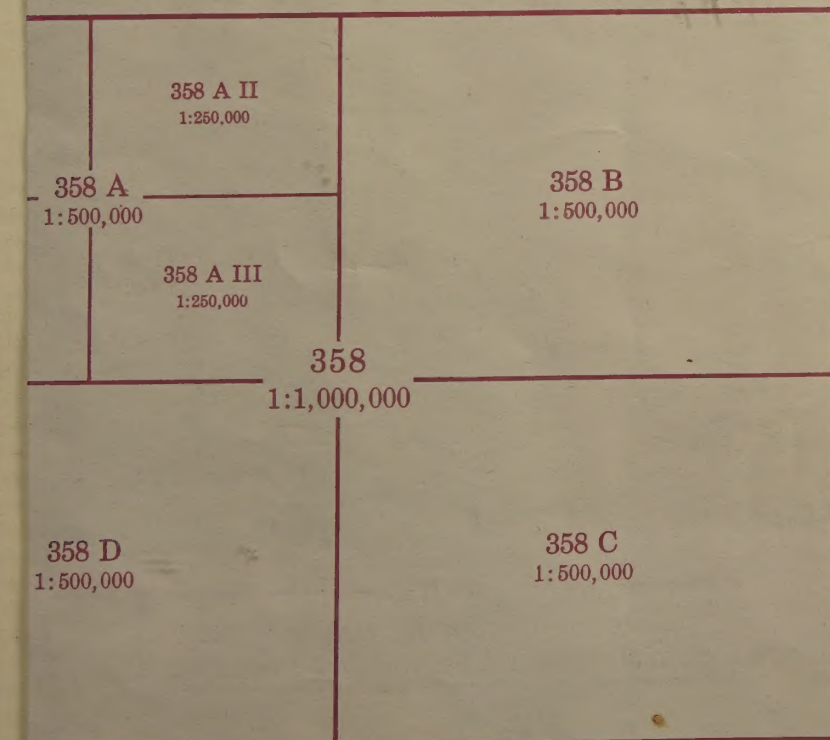
regular fold lines, but with back out.

along dotted line, and staple at points so marked.

mail box.

East of Adelaide 1:1,000,000

INTERCHART RELATIONSHIP



AERONAUTICAL SYMBOLS

AIRCRAFT FACILITIES

AIRPORTS — COMPLETE FACILITIES Refueling services, complete repairs, shelter, and (where applicable) passenger or cargo services and/or seaplane ramp with hauling-out facilities.

AIRFIELDS or SEAPLANE PORTS — LIMITED FACILITIES Refueling services for normal traffic and limited repair facilities.

SEAPLANE LANDPLANE

- | | | |
|--|--|-------------------------------|
| | | Military Base |
| | | Civil |
| | | Joint Civil and Military Base |

SEAPLANE LANDPLANE

- | | | |
|--|--|--------------------------|
| | | Military |
| | | Civil |
| | | Joint Civil and Military |

LANDING GROUNDS and ANCHORAGES

- Landing Strip — Very limited or no facilities
- Landing Area — Very limited or no facilities or information thereon not complete
- Sheltered Anchorage — Very limited or no facilities
- Emergency Anchorage — Very limited or no facilities or information thereon not complete

AIRFIELD DATA

- 18** Elevation in feet
- L** Minimum lighting; obstruction, boundary or runway lights and lighted wind indicator
- H** Hard surface runway, normally all-weather
- S** Normally sheltered take-off area
- 46** Length of longest runway to nearest hundred feet

SKYVIEW
18 LH 46

LAKE WORTH
590 LS 99

When specific information pertaining to landing facility data is lacking, the respective character is replaced by a dash (-).

SKYVIEW 18 -H 46 LAKE WORTH 590 -- 99

AIR NAVIGATION LIGHTS

Numerals in italics indicate elevation above mean sea level.

- Rotating Light ----- 110 ★
- Rotating Light (With flashing code lights) ----- -- ★
- Rotating Light (With course lights) ----- .15 ★
- Flashing Light ----- ★

- Flashing Light (With code) ----- -- ★
- Obstruction Light ----- -- ★
- Marine Light (Elevations of marine lights are above high water.) ----- Occ WRC 92
- Lightship ----- -- ★

F—Fixed
Fl—Flashing

Occ—Occulting
Alt—Alternating

Gp—Group
R—Red

W—White
G—Green

B—Blue
(U)—Unwatched

SEC—Sector
sec—Second

Marine lights are white unless colors are indicated; alternating lights are red and white unless otherwise indicated.

MISCELLANEOUS

- Mooring Mast ----- T
- Dirigible Base ----- U
- Prominent Transmission Line ----- T
- Lighted Obstruction ----- ★

- Visual Ground Sign ----- M
- Town having Visual Ground Sign ----- HOUSTON
- High Explosives Area (Marked) ----- W
- High Explosives Area (Unmarked) ----- A

Obstruction (Numerals in italics indicate elevation above sea level of obstruction top. Vertical numerals within parentheses indicate heights above ground.)

arable land. The soil is brown or reddish-brown. I see many lakes or impoundments.

We pass just north of a large sharply defined area with gently rolling relief covered with black-appearing shrubs or low trees. The soils in the fallow fields under the plane are mostly brown, with patches of gray and reddish-brown.

Near Red Bluff, there is about 45 to 55 percent arable land. Shortly beyond Red Bluff, there is very little arable land. From the plane, the land appears to be gently undulating with thin black-looking shrubs, and spots that are probably salty playas. The short slopes seem to have many shallow gullies. South of us, between this area and one shown on the map as "sand and bush" is a wide strip about one-half in fields. The land immediately beneath the plane seems to be almost a wilderness, except for a very few roads. In places, it appears that sand is drifting from northwest to southeast.^{1/}

Near Yumali and west, there are more fields -- gray and reddish-brown fallows and patches of black shrub.

We cross the Murray River at the margin of Lake Alexandrina. The soil is brown and nearly treeless, with

^{1/} Added later: Stephens says that these lower lands are solodized-Solonetz.

arable land. The soil is brown or reddish-brown. I see

many lakes or ponds.

We pass just north of a large sharply defined area

with gently rolling relief covered with black-apparing

shrubs or low trees. The soils in the fallow fields under

the plane are mostly brown, with patches of gray and

reddish-brown.

Near Red Bluff, there is about 15 to 25 percent arable

land. Shortly beyond Red Bluff, there is very little

arable land. From the plane, the land appears to be gently

undulating with thin black-looking shrubs, and spots that

are probably salty places. The short slopes seem to have

many shallow gullies. South of us, between this area and

one shown on the map as "sand and bush" is a wide strip

about one-half in fields. The land immediately beneath

the plane seems to be almost a wilderness, except for a very

few roads. In places, it appears that sand is drifting

from northwest to southeast.

Near Tumball and west, there are more fields -- gray

and reddish-brown fallows and patches of black shrub.

We cross the Murray River at the margin of lake

Alexandrina. The soil is brown and nearly treeless, with

I Added later: Stephens says that these lower lands are
solonchaks.

grayish ponds and playas and irregular brown and yellowish-brown bare spots to the south. As we go toward Adelaide, there is more arable land with brown and gray soil and some patches of black shrub. Fields show an irregular macro-mottling. Some of them are almost red.

Near the city, the land is more rolling, with many pastures containing trees, and only a few fields. As we come even closer, wood lots and fields increase at the expense of thinly wooded pastures. Some of the strongly rolling land is cultivated in small farms.

This large plane needs to go far north of Adelaide to a special air strip on brown to dark reddish-brown, slightly undulating soil that is nearly all cultivated. Perhaps one-fourth of the land is fallow, and the rest appears to be mainly in cereals.

Our pilot is not highly skillful with this big plane, and it takes a lot of dipping, circling, banking, and bumping to get down.

We arrive at about 1:14 Adelaide time. I am met by Mr. J. K. Taylor and his son, who drive me into the city. These are Reddish Chestnut soils, called locally "red-brown earth." I stop at the Hotel Berkeley and have a hurried lunch. It is very hot with a searing wind from the north. One thinks of western Kansas on a summer day, with a hot southwest wind.

grayish ponds and plays and irregular brown and yellowish-brown bare spots to the south. As we go toward Adelaide, there is more arable land with brown and gray soil and some patches of black shrub. Fields show an irregular macro-mottling. Some of them are almost red. Near the city, the land is more rolling, with many pastures containing trees, and only a few fields. As we come even closer, wood lots and fields increase at the expense of thinly wooded pastures. Some of the strongly rolling land is cultivated in small farms. This large plane needs to go far north of Adelaide to a special air strip on brown to dark reddish-brown, slightly undulating soil that is nearly all cultivated. Perhaps one-fourth of the land is fallow, and the rest appears to be mainly in cereals. Our pilot is not highly skilled with this big plane, and it takes a lot of dipping, circling, banking, and bumping to get down. We arrive at about 1:15 Adelaide time. I am met by Mr. J. K. Taylor and his son, who drive me into the city. These are Reddish Chestnut soils, called locally "red-brown earth." I stop at the Hotel Berkeley and have a hurried lunch. It is very hot with a searing wind from the north. One thinks of western Kansas on a summer day, with a hot southwest wind.

A young man calls and takes me out to the Waite Agricultural Institute. Here I have talks with Prescott, Taylor, and several reporters. I arrange with Mr. Stephens for a trip north into the desert. I go to dinner with Mr. Taylor, Mr. Prescott, and Professor G. W. Robinson. Robinson and I intend to meet in Sydney for the trip to Auckland. He is making his visit in Australia in nearly the opposite order that I need to follow.

We have a considerable discussion of the problem of organizing the International Society of Soil Science. Prescott believes with me that we should have national sections prominent in the organization, and yet somehow provide for individual membership.

We have some letters from Grange, who proposes field trips just as the New Zealand Congress begins. Robinson feels he must attend the opening sessions instead. Too bad.

Prescott tells us that the CSIR has a fairly large sum for research, around one and a half to two million pounds, whereas all the universities together have only 80 thousand.

I am back to my room early, with a few mosquitoes. It is very hot.



January 20, 1949
At Waite Agricultural Institute. L to R: J. K. Taylor,
Kellogg, Prescott, Robinson.

January 21

I am up again at 6:15 for early morning tea. I rearrange my baggage, partly for storing here, in order to travel light into the desert and on to Perth.

I go for a walk after breakfast. Only the tobacconists seem to be open before 9:00. I notice that a very large number of the men carry little brown leather satchels. They are all about alike. Skilled workers of some sort?^{1/}

Mr. Blackburn, a young scientist in the Soil Survey, comes to the hotel and takes me to the Waite Agricultural Institute. I bring along my laundry that Mr. Taylor says he will get done for me. The itinerary worked out by the CSIR looks very rough, indeed, for my poor, sore back. I go over to Prescott's house and he tells me a little about the organization here. In Australia, more taxes are now paid to the State than to the Commonwealth Government. Although, most are collected now by the latter. There is no Commonwealth Department of Agriculture, although there is a small section for agriculture in the Department of Commerce. Until 22 years ago, all of the agricultural research and advisory work was carried on by the State Departments of Agriculture. In 1926, the CSIR was

^{1/} Added later: Stephens tells me that these are called "Gladstones." They are quite unlike what we call Gladstones. They are about 18 to 20 inches long, 10 to 12 inches high, and 9 to 12 inches wide.

January 21

I am up again at 6:15 for early morning tea. I rearrange my baggage, partly for storing here, in order to travel light into the desert and on to Perth. I go for a walk after breakfast. Only the tobaccoists seem to be open before 9:00. I notice that a very large number of the men carry little brown leather satchels. They are all about alike. Skilled workers of some sort. Mr. Blackburn, a young scientist in the Soil Survey, comes to the hotel and takes me to the Waite Agricultural Institute. I bring along my laundry that Mr. Taylor says he will get done for me. The itinerary worked out by the CSIR looks very rough, indeed, for my poor, sore back. I go over to Prescott's house and he tells me a little about the organisation here. In Australia, more taxes are now paid to the State than to the Commonwealth Government. Although, most are collected now by the latter. There is no Commonwealth Department of Agriculture, although there is a small section for agriculture in the Department of Commerce. Until 22 years ago, all of the agricultural research and advisory work was carried on by the State Departments of Agriculture. In 1926, the CSIR was

I Added later: Stephens tells me that these are called "Gladstones". They are quite unlike what we call Gladstones. They are about 18 to 20 inches long, 10 to 12 inches high, and 9 to 12 inches wide.



K-1640 January 21, 1949
South Australia. Adelaide. Waite Agricultural
Research Institute.



K-1641 January 21, 1949
South Australia. Adelaide. Arboretum at Waite
Agricultural Research Institute. "Sugar gum" in
foreground.

established, and it includes a considerable section for agriculture. In terms of staff, about one-third of the CSIR activities are in agriculture, but he says only about one-fifth in terms of money. The CSIR has the following agricultural Divisions: Soils, Plant Industry, Biochemistry and Animal Nutrition, Entomology, Animal Health and Production, Fisheries, Food Preservation, and two irrigation research stations. Subject-matter Divisions also have research stations. Altogether there are about 200 scientific officers. The large wool trust funds are used mainly by the CSIR.

The State Departments of Agriculture carry on all the advisory or extension work. In New South Wales, this is a very large organization. The State departments also do some research and have field stations for the purpose. He mentions the independent Soil Conservation Service in New South Wales, which also concerns itself with forest and water conservation.

In Queensland, there is a semi-independent Bureau of Sugar Experiment Stations. Victoria is organized somewhat like New South Wales, but more centralized. They have a Soil Conservation Committee that is rather independent, but so far it has only one scientific officer. In both Western Australia and South Australia, soil conservation work is in

the Department of Agriculture. The officers in charge work cooperatively with the Lands Department in their responsibility for leasing the desert land. Tasmania has not recognized a need for any special soil conservation program.

Victoria is the only State now that has soil surveyors besides those on the staff of the CSIR. The Waite Agricultural Institute was founded in 1924. The University of Adelaide has an endowment of land and financial support from the State Government. South Australia is the only State where agricultural research and even some of the advisory work is definitely cooperative with the University. In fact, the State Department of Agriculture here has no laboratory. The enrollment is small at the University of Adelaide -- about 70 students total/ in the Agricultural Faculty

I asked him about the molybdenum work. He says the responses are rather limited to rolling areas near Adelaide, near Canberra, on the tableland of New South Wales, and on Cressy shaley clay loam/and some other soils in Tasmania. I gather that he feels that Trumble has overemphasized the molybdenum work. Prescott insists that likely the main effect is on the legume bacteria.

After tea, I talk a bit with Mr. J. K. Taylor, who is in charge of the Division of Soils of the CSIR. The Division

Note: Insertions made by C. G. Stephens.

has four main sections: (1) Soil Survey and Pedology, under Mr. Stephens, (2) Soil Physics and Mechanics, under Dr. Marshall, (3) Soil Chemistry, under Dr. Piper, and (4) a very small section for Soil Microbiology, with only two men. Perhaps around one-half or more of the effort is in the first section. They have now established five regional centers: (1) Brisbane (Hubble), (2) Canberra (Downes), (3) Deniliquin (Butler), (4) Hobart, ^(Nicolls) and (5) Perth (Smith).

The Division has 37 research officers besides technical and clerical assistance. Taylor emphasizes the present difficulty in acquiring men with adequate training. Perhaps the best source is from among the students majoring with Professor Leeper at the University of Melbourne. He says there are very few soil studies being made in Australia outside of the CSIR, except for those by Professor Teakle and a bit by Professor Leeper. He says the State Departments of Agriculture do not have men sufficiently competent to do the research required in soil surveying.

Taylor favors reconnaissance surveys to go considerably beyond Prescott's map. He suggests maps of soil associations, apparently something like those of Ellis in Canada. In broad reconnaissance, they also use larger groups of soil associations. The individual soil associations are mapped in detail on a sample basis, with the individual soil types

has four main sections: (1) Soil Survey and Pedology,
under Mr. Stephens, (2) Soil Physics and Mechanics, under
Dr. Marshall, (3) Soil Chemistry, under Dr. Piper, and
(4) a very small section for Soil Microbiology, with only
two men. Perhaps around one-half or more of the effort
is in the first section. They have now established five
regional centers: (1) Brisbane (Hubble), (2) Canberra (Downes),
(3) Adelaide (Butler), (4) Hobart, and (5) Perth (Smith).
The Division has 37 research officers besides technical
and clerical assistance. Taylor emphasizes the present
difficulty in acquiring men with adequate training. Perhaps
the best source is from among the students majoring with
Professor Langer at the University of Melbourne. He says
there are very few soil studies being made in Australia
outside of the CSIR, except for those by Professor Taskie
and a bit by Professor Langer. He says the State Departments
of Agriculture do not have men sufficiently competent to
do the research required in soil surveying.
Taylor favors reconnaissance surveys to go considerably
beyond Prescott's map. He suggests maps of soil associations,
apparently something like those of Ellis in Canada. In
broad reconnaissance, they also use larger groups of soil
associations. The individual soil associations are mapped
in detail on a sample basis, with the individual soil types

defined and named. Thus, small units of 5 to 10 thousand acres are mapped with soil type nomenclature. Thus, on many of the surveys, about 3 percent of the total area is mapped in detail. In New South Wales, this figure may be only 1 percent. (From what I have seen already, and from Mr. Taylor's discussion, I gather that detailed surveys, even these samples, here are considerably less detailed than most of those now being made in the United States.)

Taylor is interested in work in the southwestern part of Western Australia, because this region has fairly good rainfall -- 25 inches or more. The soils are deficient in phosphorus, and there are important minor nutrient deficiencies. Some settlement is going on there. The Commonwealth Government finances the settlement of veterans up to 100 percent. For this reason, progress is rather slow and so far is limited to areas with more than 25 inches of rainfall. There is usually a big clearing problem, with costs up to 40 pounds per acre. Cheaper methods are being sought. They are making sure that each settler now has at least 100 acres of cleared land. Most of this is for dairying. Some pigs are grown, and a few other crops such as apples and tobacco. This country south of Perth is too wet for sheep, because of diseases like foot rot. 7*

Since 1945, the Soil Survey has been doing a lot of service work with the appropriate State and Commonwealth

Departments dealing with land settlement. Taylor says he is sorry that so much effort needs to be put on "service work." He says he wants to do more fundamental work. He thinks that this can be done without regard to land use.

After a very pleasant lunch with Stephens en famille, we discuss the outline for a broadcast I am to make, and also books on Australia that Stephens will buy and post to me in the United States. He agrees to send me his notes from his American trip in 1948.

We go to the bank and then to the ABC Broadcasting Station, where I am met by a man with a copy of The soils that support us under his arm! I make a 12-minute platter on the possibility of a good world food supply along the lines of my recent speeches.^{1/} For this I am given a small fee that I turn over to Stephens for the books about Australia.

We then drive back to the Waite Agricultural Institute and I sample the soil in a deep pit in the arboretum. This is said to be a virgin site. The slope here is about 1 percent. The natural cover is savanna woodland with eucalyptus (odorata) and Danthonia (sp.) grasses. The land is now used mainly for wheat, with some sheep pasture.

^{1/} See the Soils men live by, U.S.D.A., and Who says the earth can't feed her people?, Successful Farming, November 1948.

Farmers get about 20 to 25 bushels of wheat to the acre, with a two- or three-course rotation of wheat-fallow, or fallow-wheat-grazing.

The local type of soil is Urrbrae loam. Locally this is called a "red-brown earth," and would be called a Reddish Chestnut, possibly planosolic, in the United States. At this time of year the soil is very dry.

Sample No. 7

A ₁₀	0-1½"	Reddish-brown loam, porous, irregular granular and blocky; easily friable. (5YR 4/4 - reddish-brown)
A ₁₁	1½-9½"	Brown (7.5YR 5/4) heavy loam, rich in silt and very fine sand. Vesicular. Massive in place, but digs out easily in irregular, small clods that are friable with difficulty. Many insect and root holes. (5YR 5/4 - reddish-brown)
A ₃	9½-13"	Transitional. Mottled red and yellowish-red light, fine sandy clay loam. Imperfect irregular nut. Hard.
B ₂	13-26"	Dark red (10R 3/6) heavy clay. Imperfectly prismatic, with coarse, angular blocks that fall into very hard medium blocks. Many roots. (10R 3/6 - dark red)
B ₃	26-34"	Red (10R 4/6), mottled slightly with dark red, clay. Transitional. Narrow tongues of B ₂ extend into this horizon. (10R 3/6 to 4/4 - weak dark red)
C _c	34-50"	Red (2.5YR 5/6) clay, mottled with gray carbonate. Massive. Hard, but less so than B ₂ . Digs out in small, very irregular nut. Tongues of B ₃ extend into this horizon.

farmers get about 20 to 25 bushels of wheat to the acre, with a two- or three-course rotation of wheat-fallow, or fallow-wheat-grass.

The local type of soil is Urbana loam. Locally this

is called a "red-brown earth," and would be called a

Reddish Chestnut, possibly planosolic, in the United States.

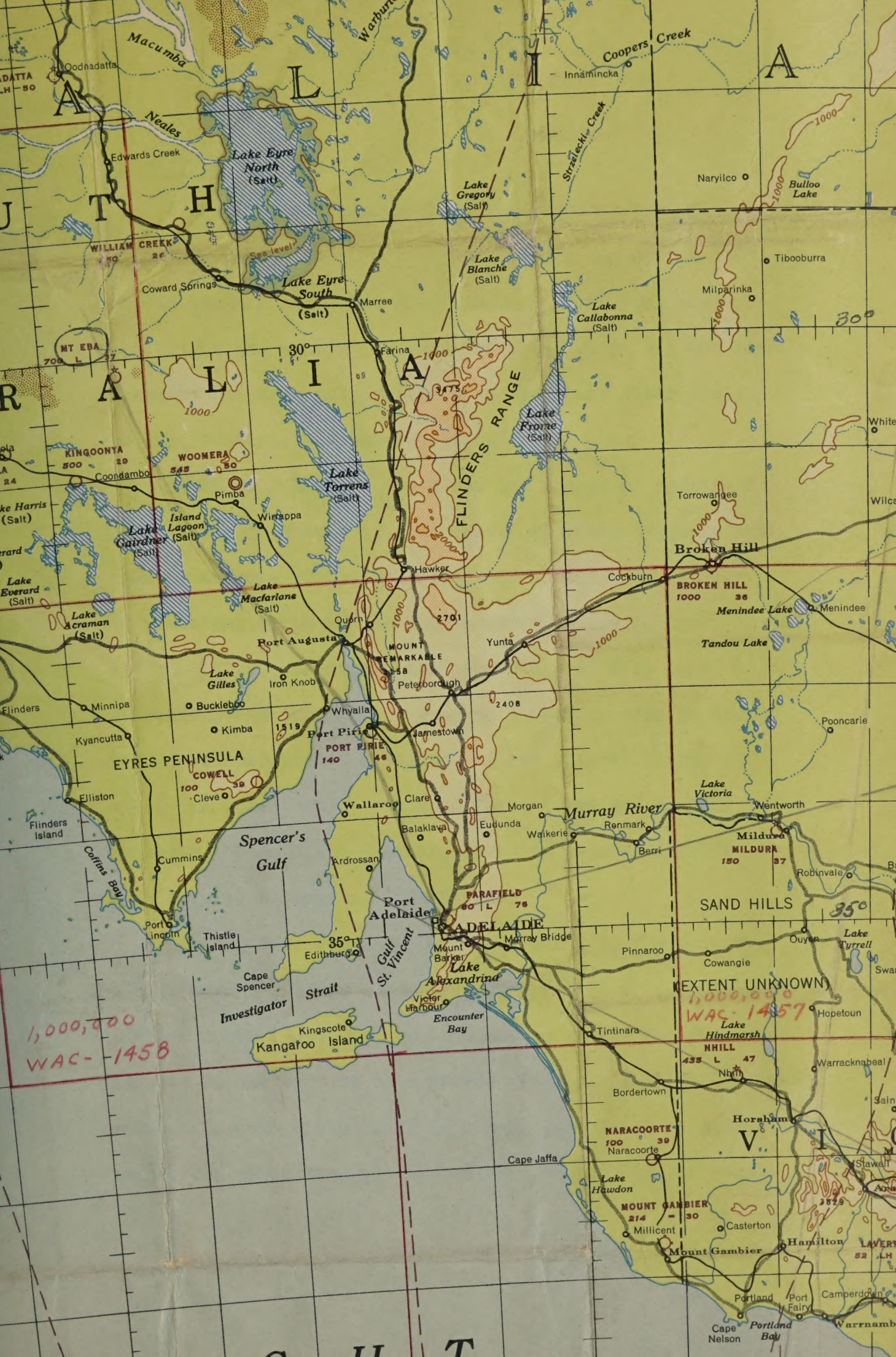
At this time of year the soil is very dry.

Sample No. 7

A10	0-1½"	Reddish-brown loam, porous, irregular granular and blocky; easily friable. (2YR 5/4 - reddish-brown)
A11	1½-2½"	Brown (7.5YR 5/4) heavy loam, rich in silt and very fine sand. Vesicular. Massive in place, but disintegrates easily in irregular, small clods that are friable with difficulty. Many insect and root holes. (2YR 5/4 - reddish-brown)
A2	2½-13"	Transitional. Mottled red and yellowish-red light, fine sandy clay loam. Imperfect irregular nut. Hard.
B2	13-26"	Dark red (10R 3/6) heavy clay. Imperfectly prismatic, with coarse, angular blocks that fall into very hard medium blocks. Many roots. (10R 3/6 - dark red)
B3	26-34"	Red (10R 4/6), mottled slightly with dark red, clay. Transitional. Narrow tongues of B2 extend into this horizon. (10R 3/6 to 4/4 - weak dark red)
C2	34-50"	Red (2.5YR 5/6) clay, mottled with gray carbonate. Massive. Hard, but less so than B2. Digs out in small, very irregular nut. Tongues of B2 extend into this horizon.

C 50"± Like the above, but with less mottling of the gray carbonate. The parent material is alluvium from the uplands laid down in coalescing fans. It contains a few sandstone pebbles. (Mainly 2.5YR 4/6 - red)

Back at the Institute I see Dr. Marshall for a few minutes, and we discuss some problems of soil texture and soil structure. Then I say good-bye to Prescott. I stop at Mr. Taylor's home and chat with him and Mrs. Taylor for a few minutes. Then back to my hotel for early packing and early sleeping before the journey tomorrow.



16 Belvidere - Mt Eba

January 22

I am up at 4:15 and meet Mr. Stephens at the air office at 4:45. We go out to the airport in the bus and are in the air for Mount Eba at 6:09. It is cool now, but bright and sunny. At least near the city, all the land seems to be under cultivation with wheat and other small grains, pasture, and patches of lucerne.

North of Dublin, I see a few low ridges of reddish sand, lying northwest by southeast. Stephens suggests that this is an area of the Mallee or "brown solonized soil." It makes one think of the Reddish-Brown soils in the United States. Gradually the percentage of crop land decreases, and soon we are over soil that appears to have well-developed croute calcaire. I see several flocks of sheep and some cattle. On some farms there are contour terraces. Near South Hummocks there is less wind-drift and even several patches of thin forest.

We pass over Bumbunga Lake -- a salty body with very little water. Nearby are many roughly circular gray playas. Further north I see deep gullies coming out of the Hummock Range. To the west of this narrow range are Reddish Chestnut soils. On both sides of it is a high percentage of arable land. The vegetation is thin on the rounded hills of the



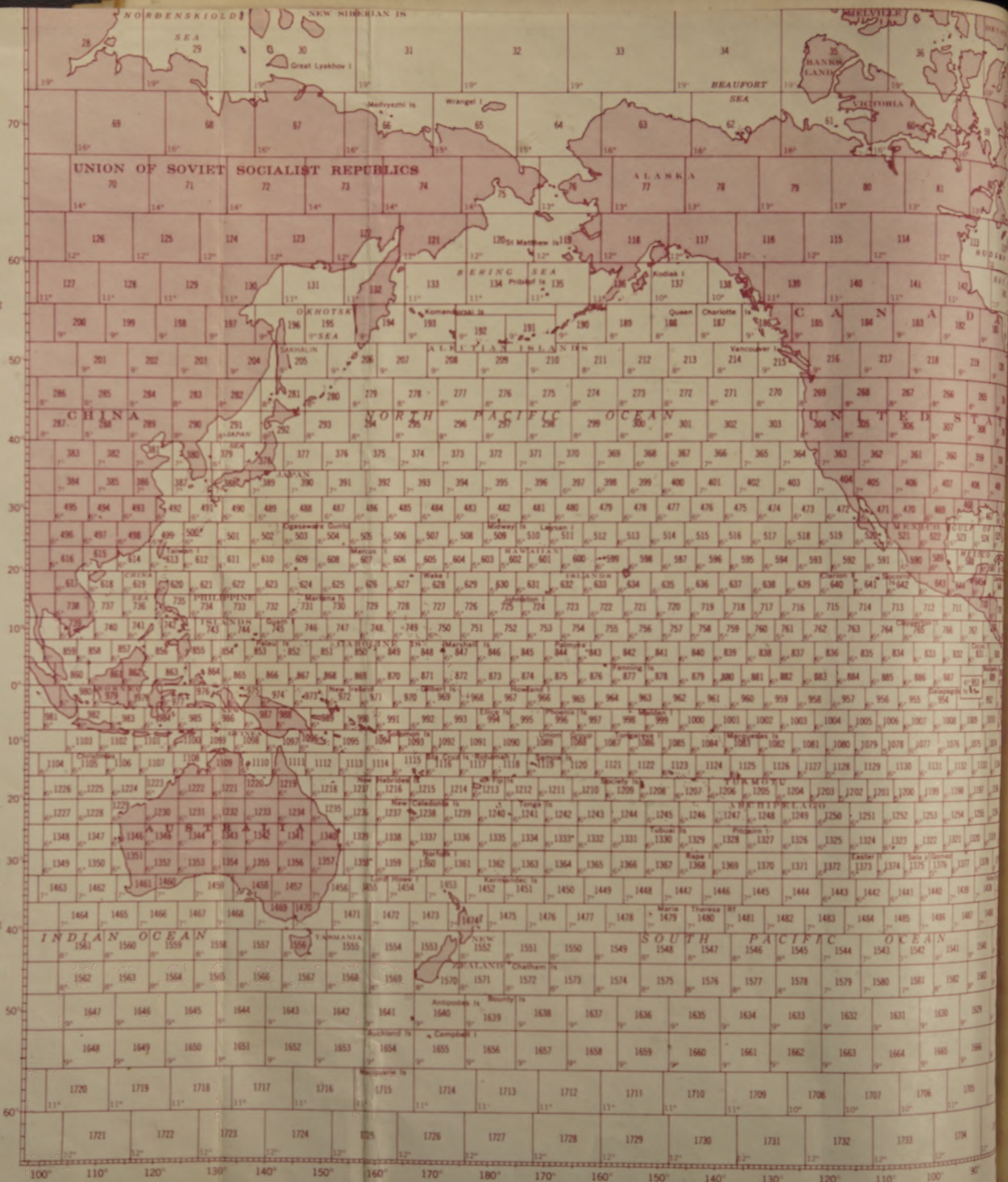
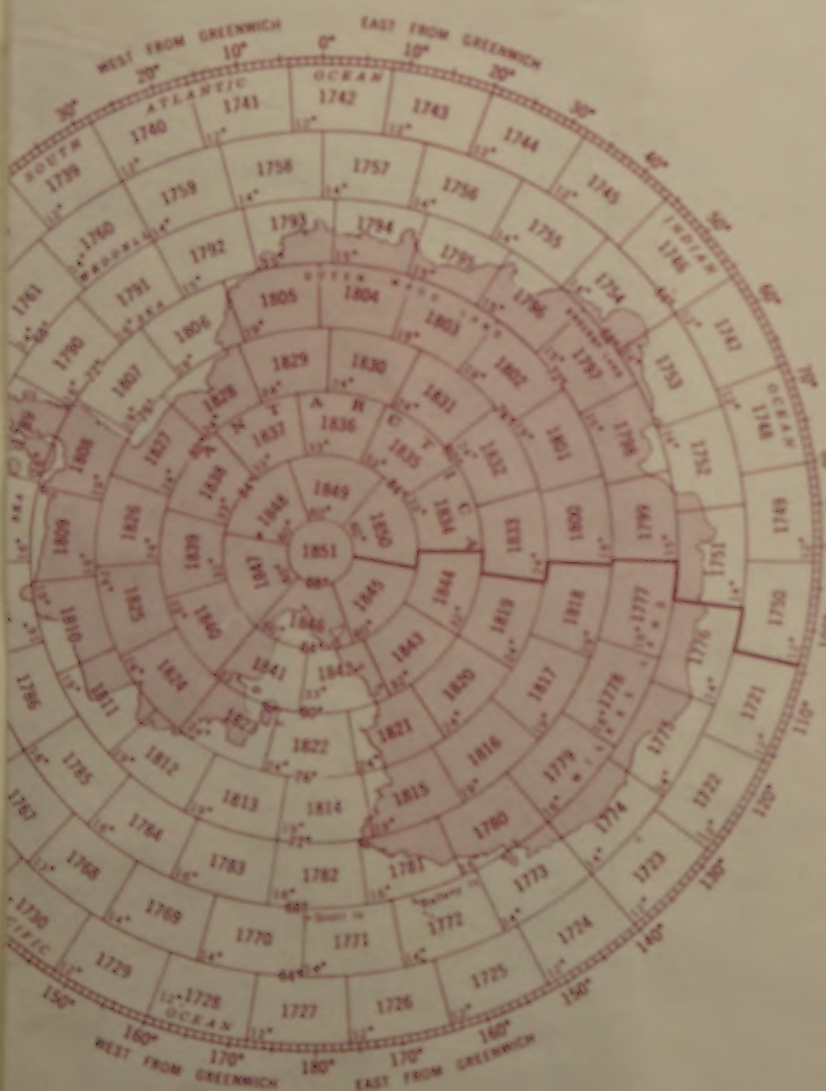
NORTH POLAR AREA

North West of Adelaide

1:1,000,000



SOUTH POLAR AREA



WORLD AERONAUTICAL CHART

Scale of Series 1:1,000,000



K-1642 January 22, 1949
South Australia. North of Red Hill. Reddish-Chestnut
soils (?).



K-1643 January 22, 1949
South Australia. North of Red Hill. Reddish-Chestnut
soils (?). Another view.

range itself, with only a few scattered trees. In the
range are a few shallow gullies. Just beyond it is
another bit of Reddish-Chestnut soil.

North of Red Hill, we are back over the hollow soils.
We cross Spencer Gulf from near Port Pirie to Lowly Point.



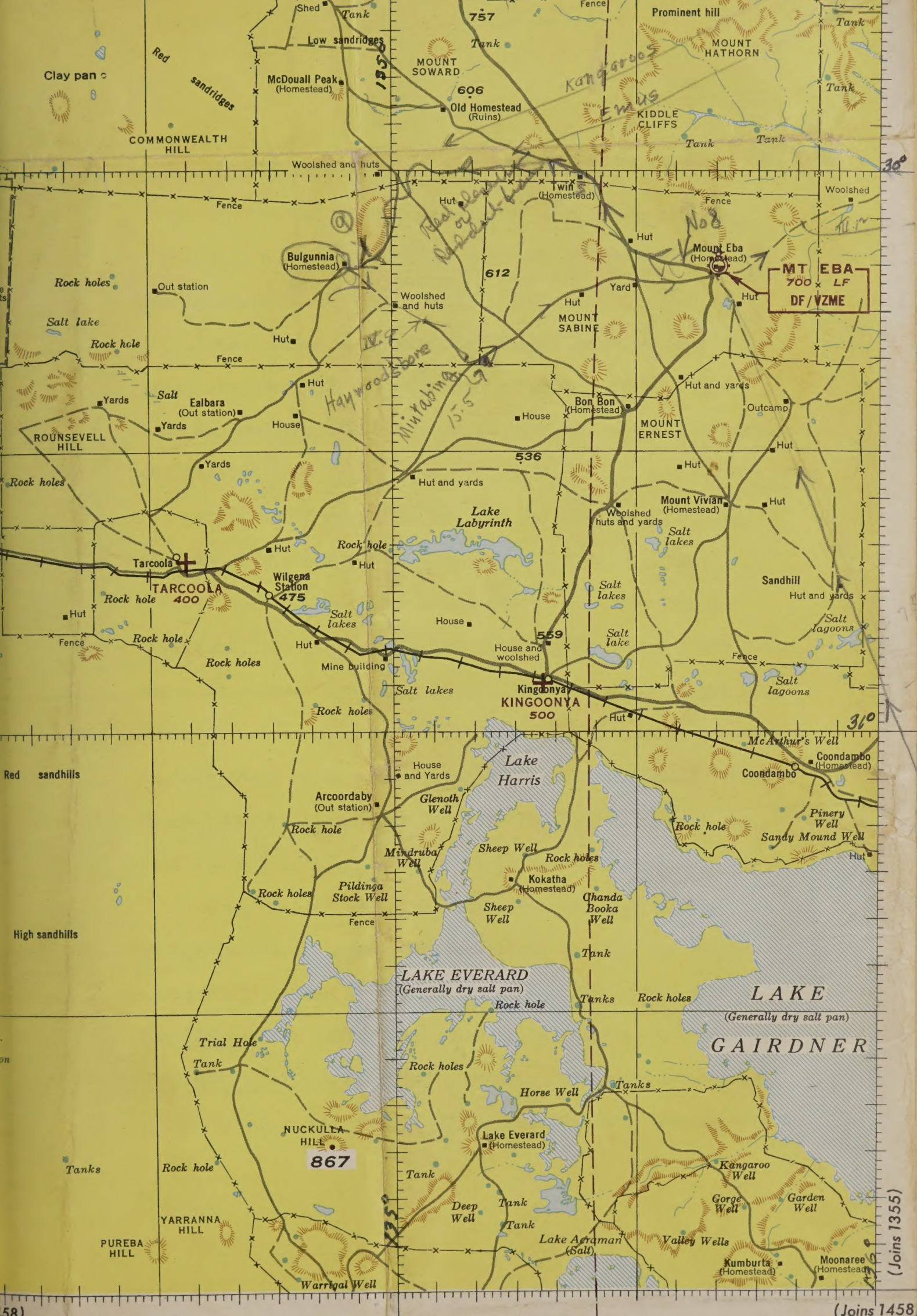
K-1644 January 22, 1949
South Australia. North of Red Hill. "Malee" soils.

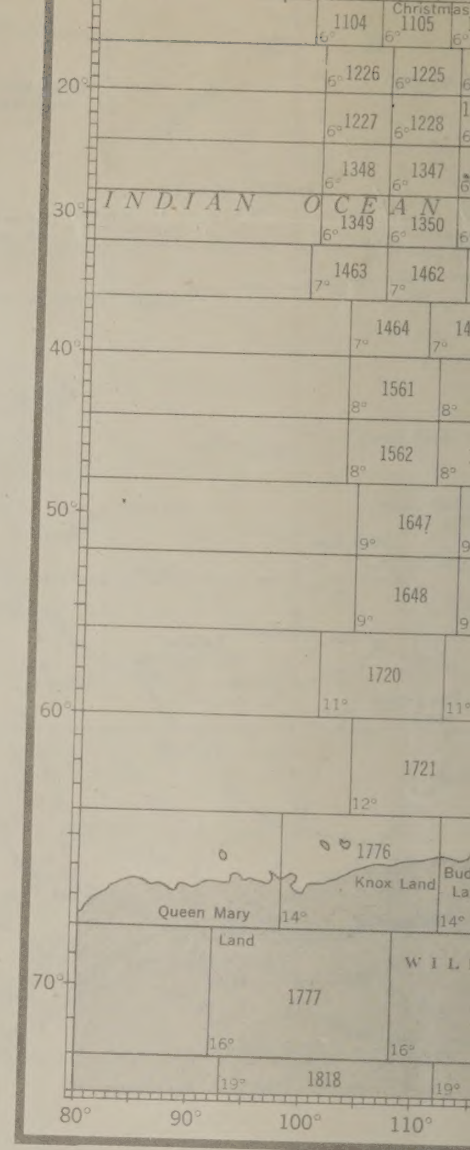
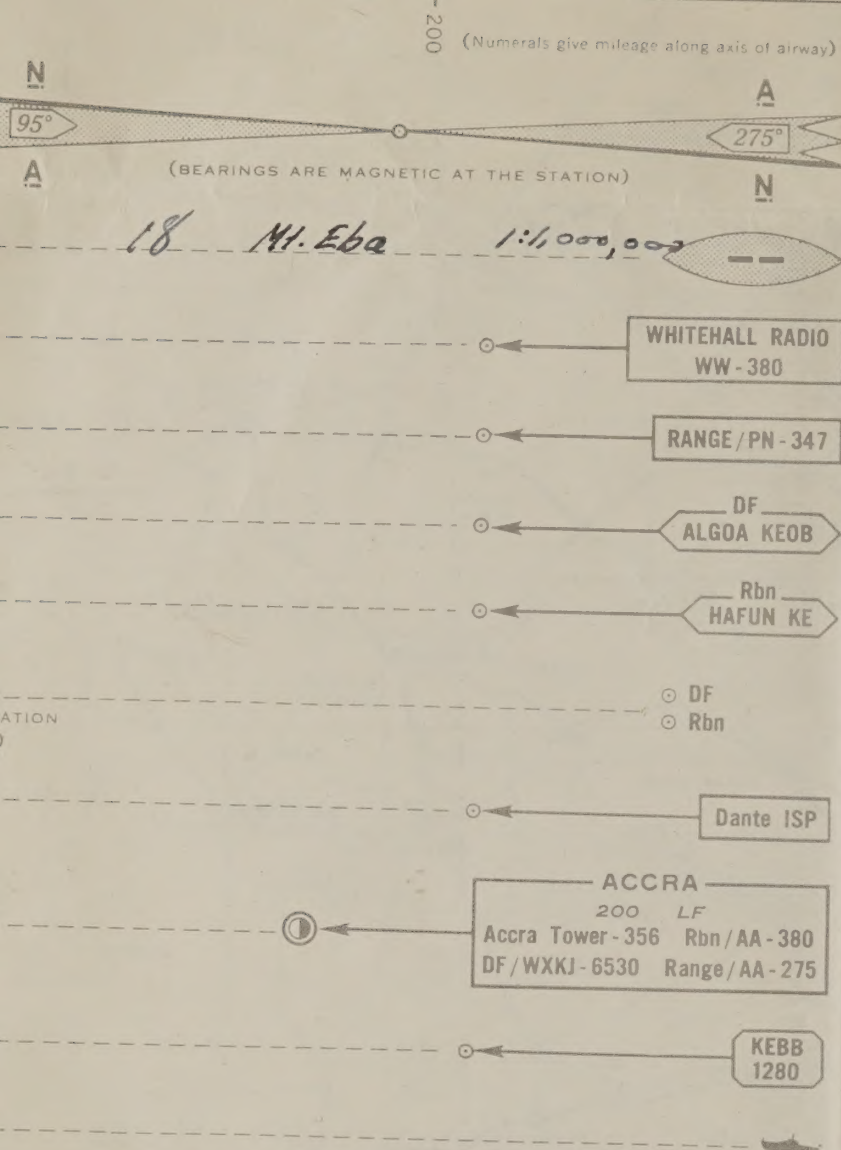
range itself, with only a few scattered trees. In the range are a few shallow gullies. Just beyond it is another bit of Reddish Chestnut soil.

North of Red Hill, we are back over the Mallee soils. We cross Spencer Gulf from near Port Pirie to Lowly Point. According to Prescott's map, we are supposed to be over "desert loams." This is sheep range on thin grass and shrub. The soil appears to be red, at first undulating, then rolling. I see a few small gullies and a very few salty playas. There are scattered tracks and headquarters for sheep herders, especially near the water holes. The vegetation is thin and there are some gullies. (This is likely due to having too few wells for the area grazed.)

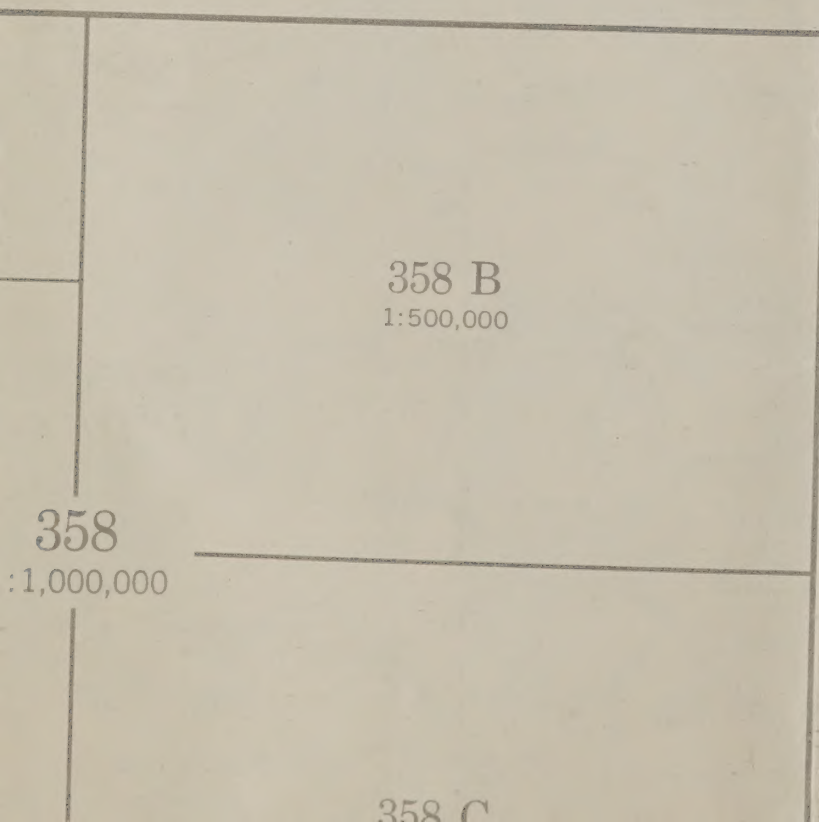
We fly east of Lake Gairdner over several large salty playas, but the rest of the land, as before, is red soil under thin grass and shrubs. I suspect the land is rather heavily grazed. A few rocky areas seem to be nearly bare.

We come down at Mt. Eba at 8:12 a.m., and have tea with Mr. and Mrs. Crombie. Present also are Mr. Fred Jessup, of the South Australia Department of Agriculture, and his Assistant, Mr. Gatenby. Miss Ernst is also present. She keeps the books for the sheep station and for the air station. Mr. Crombie could easily pass for a Texas in appearance. He





RT RELATIONSHIP



AERO

1. Aeronautical charts, maps and p
current edition of the AAF "Catalog of A
appearing in the Catalog will be procured
identified in requisitions as to name or n
2. Requisitioning.
 - a. Outside Continental United
 - (1) AAF activities are to su
Commander for mainten
 - (2) Theater supply facilities
nautical charts and ma
Service, Washington, D.
 - b. Within Continental United S
be submitted to appropriate Regional Sto
Aeronautical Chart Catalog. Except when
to bear the signature or approval by indor
requested are to be such as to assure the n
3. Obsolete Charts.
 - a. Aeronautical charts rendered
with new edition, are to be salvaged if fea
accordance with provisions of AR 380-5.

has charge of this Mt. Eba sheep station that includes about 800 square miles. He tells me that sheep men run about 700 in a flock. He has about 20 of these and 40 cattle besides.

Recent rains have made the country somewhat more green than normally at this time of year. The big rains came at Christmas time. Today is warm and sunny, but fairly cool inside.

Mr. Crombie says that grasses have increased during the past few years at the expense of the bush.

We walk around the station a bit, and look into the wool shed. The flies are simply terrible. About 10:00 a.m., we drive east of the sheep station through shrub steppe on Prescott's "desert loams." Stephens says the current view is that these soils are developed from old truncated soils. Truncation probably began in early Pleistocene. Most of the country is smooth, with very little deep drainage.

About 2 miles out, I look at the soil in a gently undulating place under scattered trees (myall) and shrubs (blue bush). This blue bush, Kochia sedifolia and Kochia planifolia (the better one), resembles the "sagebrush" (Artemisia) of western United States, but the blue bush is eaten by the animals when the grasses are low. The salt bush

is also eaten. I am told that these plants absorb water from the air through their leaves when the relative humidity exceeds 70 percent, as well as from the soil. Thus, although the rainfall here is only about 6 inches, the vegetation suggests a shrub steppe rather than a true desert.

On the surface of the soil is a fairly well developed pavement of secondary siliceous material. The surface pebbles have a dark red varnish.

This soil is called locally the Twins type.

A ₁₀	0- $\frac{1}{4}$ "	Loose red sand and pebbles.
A ₁₁	$\frac{1}{4}$ -5"	Reddish-brown (2.5YR 5/4) sandy loam or fine sandy loam. Slightly compact and massive, but easily friable. Some pebbles.
A ₃	5-10"	Transitional.
C _c	10-20"+	White, discontinuously consolidated crôte calcaire, mottled with light reddish-brown. Most of the material is siliceous. Roots enter easily.

There are many outcrops of the crôte calcaire on gentle slopes.

About 3 miles out, I look at a disturbed section of the Eba type on the margin of a small gully. The land is nearly level. There is a fair desert pavement with reddish-brown varnish. The cover is scattered trees and shrubs, as before, but with some grass.

is also eaten. I am told that these plants absorb water from the air through their leaves when the relative humidity exceeds 70 percent, as well as from the soil. Thus, although the rainfall here is only about 6 inches, the vegetation suggests a shrub steppe rather than a true desert.

On the surface of the soil is a fairly well developed pavement of secondary siliceous material. The surface pebbles have a dark red varnish.

This soil is called locally the Twin type.

A ₁₀	0-1 1/2"	Loose red sand and pebbles.
A ₁₁	1 1/2-2"	Reddish-brown (2.5YR 5/4) sandy loam or fine sandy loam. Slightly compact and massive, but easily friable. Some pebbles.
A ₂	2-10"	Transitional.
C ₀	10-20" +	White, discontinuously consolidated crinite calcareous, mottled with light reddish-brown. Most of the material is siliceous. Roots enter easily.

There are many outcrops of the crinite calcareous on gentle slopes.

About 3 miles out, I look at a disturbed section of the Eba type on the margin of a small gully. The land is nearly level. There is a fair desert pavement with reddish-brown varnish. The cover is scattered trees and shrubs, as before, but with some grass.



K-1645 January 22, 1949
South Australia. 2 miles east of Mt. Eba Station.
View of shrub steppe on Prescott's "desert loams."
Local Twin type. Scattered trees: myall; low shrubs:
bluebush.



K-1646 January 22, 1949
South Australia. 3 miles east of Mt. Eba Station.
Shallow gully in Eba type (of Prescott's "desert
loams"). (Mr. Stephens)

- | | | |
|------------------|---------|---|
| A | 0-6" | Red (2.5YR 5/8) clay. Very roughly prismatic, that digs out in easily friable coarse granular. |
| B-C _c | 6-18" | Transitional. Digs out in rough clods that are easily friable. Some calcium carbonate and calcium sulphate. |
| C | 18-20"+ | Red (2.5YR 5/8), softly friable, mellow clay, with some small streaks of lime. |

I am told that around 15 sheep per square mile can be carried on this land, one year with another. Unfortunately, some areas of it haven't yet water for stock.

We continue east and I see some remnants of an old plain -- small mesas around 300 feet above the plain. The elevation of the plain itself is about 400 to 450 feet.

Fifteen miles east of Mt. Eba Station, I look at the Arcoona type, which is a complex consisting of (1) shelf, with good desert pavement from "billy" (= secondary siliceous material), gravel, and cobbles, (2) crab holes, where water collects, and (3) puff spots. Unfortunately, our time is very limited, and the soils can only be examined with a big auger.

On the shelf. The very surface is red sand, gravel, and cobbles.

- | | | |
|----------------|------|--|
| A ₁ | 0-8" | Red (2.5YR 4/8) clay, with slight mottling of shades. Easily friable, irregular nut. |
|----------------|------|--|

A 0-6" Red (S. 5YR 5/8) clay. Very roughly prismatic, that dips out in easily friable coarse granular.

B-C 6-18" Transitional. Dips out in rough clods that are easily friable. Some calcium carbonate and calcium sulphate.

C 18-30" Red (S. 5YR 5/8), soft friable, mellow clay, with some small streaks of lime.

I am told that around 15 sheep per square mile can be carried on this land, one year with another. Unfortunately, some areas of it haven't yet water for stock.

We continue east and I see some remnants of an old plain -- small mounds around 300 feet above the plain. The elevation of the plain itself is about 100 to 150 feet. Fifteen miles east of Mt. Bos Station, I look at the Arcon type, which is a complex consisting of (1) shales, with good desert pavement from "billy" (= secondary siliceous material), gravel, and cobbles, (2) crab holes, where water collects, and (3) buff spots. Unfortunately, our time is very limited, and the soils can only be examined with a big auger.

On the shore. The very surface is red sand, gravel, and cobbles.

A 0-8" Red (S. 5YR 5/8) clay, with slight mottling of shades. Easily friable, irregular out.

- | | | |
|-------------------|---------|---|
| A ₃ | 8-24" | Slightly darker red and more compact. Some pebbles. |
| C _s -C | 24-30"+ | Pale red clay, mottled with white (gypsum). Friable when removed. Less gray with depth. (No effervescence with acid!) |

Crab Hole. Rocky and muddy, intermittently ponded.

There are irregular surface cracks two to three inches wide.

Puff Spot. This looks like the puff Solonchak in general appearance. These are about five inches higher than the crab holes.

- | | | |
|-------------------|--------|--|
| A ₁ | 0-6" | Yellowish-red (5YR 5/8) granular clay. This is very easily friable, almost fluffy. |
| A ₃ | 6-24" | Yellowish-red clay, with gradually increasing compactness. |
| C _s -C | 24-36" | Yellowish-red, heavy, sticky, plastic clay, with slight gray mottling with gypsum. (No effervescence with acid!) |

This complex is likely some sort of hydrologic phenomenon, due in part to slight upward pressure of underground seep water, along with the "swallowing" of fine surface material in the cracks.

There are some forb plants and grass in the crab-hole part, and more in the puff part. There is not much vegetation on the shelf.

We drive back to the Mt. Eba Station for lunch, and then out north and west toward the Twins Station.

Slightly darker red and more compact. Some pebbles.

8-24"

Pale red clay, mottled with white (gypsum). Friable when removed. Less gray with depth. (No effervescence with acid!)

24-30"

C₂-C

Crap Hole. Rocky and muddy, interstitially bonded.

There are irregular surface cracks two to three inches wide.

Puff Spot. This looks like the puff Solonchak in

general appearance. These are about five inches higher than

the crab holes.

Yellowish-red (2YR 5/8) granular clay. This is very easily friable, almost flaky.

0-6"

A₁

Yellowish-red clay, with gradually increasing compactness.

6-24"

A₂

Yellowish-red, heavy, sticky, plastic clay, with slight gray mottling with gypsum. (No effervescence with acid!)

24-36"

C₂-C

This complex is likely some sort of hydrologic phenomenon,

due in part to slight upward pressure of underground seep

water, along with the "swallowing" of fine surface material

in the cracks.

There are some forb plants and grass in the crab-holes

part, and more in the puff part. There is not much vegetation

on the shell.

We drive back to the Mt. Rosa Station for lunch, and

then out north and west toward the Twin Station.



K-1647 January 22, 1949
 South Australia. 15 miles east of Mt. Eba Station.
 Arcoona complex of puff and "crab holes."
 (L: Mr. Jessup; R: Mr. Stephens)



K-1648 January 22, 1949
 South Australia. 15 miles east of Mt. Eba Station.
 Vermin fence, against rabbits and dogs.

About 3 miles northwest of Mt. Eba Station, we stop on a nearly level plain. There are a few trees, thin shrubs and thin grass. The soil is said to be a slight variation of the Eba type because of the thin bleached layer. There is a dark red, fine gravel pavement. Here the rainfall is $6\frac{1}{2}$ inches.

Sample No. 8

A ₁₀	0- $\frac{1}{4}$ "	Red (1OR $\frac{4}{6}$), loose sand and gravel. (1OR $\frac{4}{6}$ - red)
A ₁₁	$\frac{1}{4}$ - $3\frac{1}{2}$ "	Red (1OR $\frac{5}{8}$), loose, imperfectly granular, sandy loam. Some pebbles. (1OR $\frac{5}{8}$ - red)
A ₂	$3\frac{1}{2}$ -6"	Compact but friable, mottled light red and shades of red, sandy loam. A noticeable grayish cast along the cracks suggests leaching. (A bit lighter than 1OR $\frac{5}{8}$ - red)
B ₂₁	6-28"+	Red (1OR $\frac{4}{6}$ - $\frac{3}{6}$) clay. Angular, medium to small blocky. Quite easily friable. (7.5R $\frac{4}{6}$ - strong red)
B ₂₂		Similar to above. Sample taken at 28 inches. (1OR $\frac{4}{8}$ - red)

(Unfortunately, this had to be sampled with a big auger.)

The vegetation on these soils is more dense in the depressions and in the more sandy areas.

We need to stop for tea with Mr. and Mrs. Rankin at the Twins Station, because that is what one does in this country. There are about 6,000 sheep on this station of 540 square miles.



K-1649 January 22, 1949
South Australia. 3 miles northwest of Mt. Eba Station.
Local Eba type, with bleached layer, in Prescott's
"desert loams."



K-1650 January 22, 1949
South Australia. 43 miles west and north of Twins
Sheep Station. Mulga shrubs on so-called "solonized
desert loam."

After tea, we drive northwest. The soil seems to be near the border between Reddish-Brown and Red Desert.

About 15 miles out, I see two emus -- large, ostrich-like birds that have no feathers of value. Then a little later, I see several kangaroos and try to photograph one.

We drive for miles over this nearly level to gently undulating "shrub steppe." In places, Mulga shrubs are fairly thick; other places have the low ($1\frac{1}{2}$ - $2\frac{1}{2}$ ') blue bush; and other places are nearly barren. The grass is best under the shrubs and in the depressions. Vegetation is most prominent on the sandy places, but this is said to be less nutritious. We see many more wild kangaroos; and follow a winding track, dim in places, through several paddock gates, and only part of which have car passes.

The soils certainly belong to one great group. They vary greatly in *crouê calcaire*. Some have scarcely any calcium carbonate. Of those with *crouê calcaire*, the depth to it varies from a few inches to 3 or 4 feet. Most of the soils are heavy in texture beneath the very surface, but some are sandy. This whole area is a great plain made up principally of coalescing, gentle fans, with depressions and wide, shallow water courses. Some of these water courses have sandy margins, although sandy soils are not

After tea, we drive northwest. The soil seems to be near the border between Reddish-brown and Red Desert. About 12 miles out, I see two small, dark, oval-like birds that have no feathers of value. Then a little later, I see several kangaroos and try to photograph one. We drive for miles over this nearly level to gently undulating "sandy steppe." In places, *Mitella* shrubs are fairly thick; other places have the low ($1\frac{1}{2}$ - $2\frac{1}{2}$ ft) dense bush; and other places are nearly barren. The grass is best under the shrubs and in the depressions. Vegetation is most prominent on the sandy places, but this is said to be less nutritious. We see many more wild kangaroos; and follow a winding track, in places, through several paddock gates, and only part of which have car passes. The soils certainly belong to one great group. They vary greatly in coarse calcare. Some have scarcely any calcium carbonate. Of those with coarse calcare, the depth to it varies from a few inches to 3 or 4 feet. Most of the soils are heavy in texture beneath the very surface, but some are sandy. This whole area is a great plain made up principally of coalescing, gentle fans, with depressions and wide, shallow water courses. Some of these water courses have sandy margins, although sandy soils are not

confined to these present shallow streams. Most of the soils have highly or fairly well developed, well varnished desert pavements. The soils seem most too shallow for Reddish-Brown, but are most too well developed and too well covered for Red Desert.

At about 43 miles from Twins, I look at a soil called locally "a strong brown solonized soil" -- one of the types in Prescott's "desert loam." (I doubt the "solonized" part.) The surface is a pebbly pavement.

- | | | |
|----------------|--------|---|
| A ₁ | 0-5" | Red (10R 5/8), friable sandy loam, with some pebbles. |
| C _c | 5-24"+ | Red and white mottled, imperfectly indurated calcareous clay. The color fades a bit in depth. |

This nearly level soil has Mulga (Acacia aneura) shrubs about 10 feet high, and a little grass.

Further on, we stop for just a moment (but long enough for me to lose my Sigma Xi key) on an undulating sandy area. There are scattered Mulga and other shrubs and rather more grass growing in patches. There is said to be Jurassic sandstone beneath. The surface has really been moved by the wind a bit.

Sample No. 9 (A₁ only)

- | | | |
|----------------|-------|---|
| A ₁ | 0-30" | Nearly loose, red loamy sand.
(10R 3/6 to 4/8 - red to dark red) |
| C _c | 30" + | Red and gray mottled croute calcaire in sand. |

confined to these present shallow streams. Most of the
soils have highly or fairly well developed, well varnished
desert pavements. The soils seem most too shallow for
reddish-brown, but are most too well developed and too well
covered for Red Desert.

At about 1/2 miles from Twins, I look at a soil called
locally "a strong brown solonchized soil" -- one of the types
in Prescott's "desert loam." (I doubt the "solonchized" part.)
The surface is a pebbly pavement.

A₁ 0-2" Red (10R 5/8), friable sandy loam,
with some pebbles.

C₀ 2-3 1/2" Red and white mottled, imperfectly
infused calcareous clay. The
color fades a bit in depth.

This nearly level soil has *Mulga* (*Acacia anaura*) shrubs

about 10 feet high, and a little grass.

Further on, we stop for just a moment (but long enough

for me to lose my sign It key) on an undulating sandy area.

There are scattered *Mulga* and other shrubs and rather more

grass growing in patches. There is said to be Jurassic

sandstone beneath. The surface has really been moved by

the wind a bit.

Example No. 2 (A₁ only)

A₁ 0-30" Nearly loose, red loamy sand,
(10R 3 1/2 to 4 1/8 - red to dark red)

C₀ 30" + Red and gray mottled coarse calcareous
in sand.

At 6:00 we arrive at the Bulgunnia Sheep Station.

Mr. Neill is the manager. We have a pleasant dinner en famille.

There is still a good deal of talk about the big rain at Christmas time, and the prospects in the various paddocks, and the need for more rain. Mr. Jessup, who accompanied Mr. Stephens and me, is making a survey of the range conditions, including both soil and vegetation. He has been working with managers of these sheep stations and encouraging them to increase the number of watering places and reduce the size of the pastures.

After dinner, we sit in a bit of lawn under very bright stars. There is a great deal of discussion about the condition of the local roads to various places. These are all called "tracks."

I record a sample of the conversation of Mr. Neill and Mr. Jessup.

J: Maybe you might go North with me?

N: Unh. Grease the truck, eh?

J: Unh.

(Silence)

N: When you going?

J: Unh. May, June. Right?

N: Unh. Bit hard. We shear in June, eh? April might do.

At 6:00 we arrive at the Bulgwani Sheep Station.
Mr. Wells is the manager. We have a pleasant dinner on famille.
There is still a good deal of talk about the big rain at
Christmas time, and the prospects in the various paddocks,
and the need for more rain. Mr. Jessup, who accompanied
Mr. Stephens and me, is making a survey of the range condi-
tions, including both soil and vegetation. He has been
working with managers of these sheep stations and encourag-
ing them to increase the number of watering places and
reduce the size of the pastures.
After dinner, we sit in a bit of lawn under very bright
stars. There is a great deal of discussion about the con-
dition of the local roads to various places. These are all
called "cracks."
I record a sample of the conversation of Mr. Wells and
Mr. Jessup.
J: May we you might go North with me?
M: Uh. Grease the truck, eh?
J: Uh.
(Silence)
M: When you going?
J: Uh. May, June. Right?
M: Uh. Bit hard. We shear in June, eh? April might
do.

J: Unh. Drop a line.

(Silence)

N: Eh, what do? Kick around a blue bush or two?

J: Unh. Maybe count a few.

(Silence)

J: You could get along. You know them.

N: Unh. Don't know them in that country. (Then mentions several that he knows.)

J: I'll drop a line.

I presume this completed all the arrangements for a field trip to the North in April to estimate the vegetation.

Then, I go to bed after a long day with a sore back.



K-1652 January 23, 1949
South Australia. Bulgunnia Sheep Station.



K-1653 January 23, 1949
South Australia. 15 miles east of Bulgunnia.
Haywood's bore — a typical watering place for
sheep.

January 23

I am up early and try some photographs around the station; but this is hard to do, because the station is so low and flat.

We leave for Mt. Eba Station again about 8:45. It is clear, bright, and hot. We drive southeast. The country has very little regular drainage, at least on the Mt. Eba type. The last heavy rain simply swept over broad areas.

Most of the grass is under the shrub, especially the tall ones 6 to 12 feet high, because of (1) shade, (2) mulch, and (3) seed covering.

I take more pictures, but the soils are about like those already described.

We reach Mt. Eba in time to have lunch with Mr. and Mrs. Crombie. This is very pleasant. Although very hot outside, it is cool in the house. Mrs. Crombie's accent sounds so like London to me that it seems most incongruous here in the dry bush.

We get on the plane and are away just before 3:00. We fly back to Adelaide along the same route. I get to my hotel about 6:00. I have a light supper, read a while, and go to bed very tired, but glad to have had this trip into the sheep country.

January 23

I am up early and try some photographs around the station; but this is hard to do, because the station is so low and flat.

We leave for Mt. Kilauea station again about 8:15. It is clear, bright, and hot. We drive southeast. The country has very little regular drainage, at least on the Mt. Kilauea type. The last heavy rain simply swept over broad areas.

Most of the grass is under the shrub, especially the tall ones 6 to 12 feet high, because of (1) shade, (2) muck, and (3) seed covering.

I take more pictures, but the soils are about like those already described.

We reach Mt. Kilauea in time to have lunch with Mr. and Mrs. Crombie. This is very pleasant. Although very hot outside, it is cool in the house. Mrs. Crombie's accent sounds so like London to me that it seems most incongruous here in the dry bush.

We get on the plane and are away just before 3:00. We fly back to Adairville along the same route. I get to my hotel about 6:00. I have a light supper, read a while, and go to bed very tired, but glad to have had this trip into the sheep country.

January 24



K-1654 January 23, 1949

South Australia. A few miles north of Adelaide
on Reddish-Chestnut soil.

January 24

I am up and sort out my baggage again, because this also promises to be a long day.

Mr. Stephens picks me up about 9:00, and we go out northeast of Adelaide through a market gardening area, over a black soil developed on an old alluvial terrace. This is called a "black earth." That hardly seems right. Perhaps it is some sort of transition between Rendzina and Chernozem.

Stephens tells me that the rainfall in the hills goes up about 80 points for each 100 feet rise in elevation on the west-facing slopes. The eastern slopes are complicated by rain-shadow effects.

Nineteen miles northeast of Adelaide in the Precambrian Hills, I look at the soil in a strong slope under a thin forest and grass. Stephens regards this as a Red Podzolic soil. It is said to be slightly acid throughout. It certainly is on the dry side for Red Podzolic. The trees are eucalyptus leucoxylon, with an understory of bracken and grass. The soil has been slightly disturbed.

A ₀	0	Very, very thin.
A ₁	0-4"	Reddish-brown (2.5YR 4/4), fine sandy loam. Easily friable and coarsely granular.

January 24

I am up and sort out my baggage again, because this
also promises to be a long day.
Mr. Stephens picks me up about 9:00, and we go out
northeast of Adelaide through a market gardening area,
over a black soil developed on an old alluvial terrace.
This is called a "black earth." That hardly seems right.
Perhaps it is some sort of transition between Rendzina and
Chernozem.
Stephens tells me that the rainfall in the hills goes
up about 80 points for each 100 feet rise in elevation on
the west-facing slopes. The eastern slopes are complicated
by rain-shadow effects.
Nineteen miles northeast of Adelaide in the Precambrian
Hills. I look at the soil in a strong slope under a thin
forest and grass. Stephens regards this as a Red Podzolic
soil. It is said to be slightly acid throughout. It
certainly is on the dry side for Red Podzolic. The trees
are encalyptus lancoxydon, with an understory of bracken
and grass. The soil has been slightly disturbed.
A₀ Very, very thin.
A₁ 0-1 1/2 Reddish-brown (2.5YR 4/4), fine sandy
loam. Easily friable and coarsely
granular.



K-1655 January 24, 1949
 South Australia. 19 miles northeast of Adelaide.
 Landscape on Red Podzolic soils (?). Eucalyptus
 (leucoxylon) trees with bracken and grass beneath.



K-1656 January 24, 1949
 South Australia. 19 miles northeast of Adelaide. Red
 Podzolic soils (?). Eucalyptus (leucoxylon) trees with
 bracken and grass beneath. Another view.

- | | | |
|----------------|-----------------|---|
| A ₂ | 4-7" | Red (2.5YR 5/8), heavy, fine sandy loam. Medium granular. Quite easily friable. |
| A ₃ | 7-15" | Red (10R 4/8), fine sandy clay. Rather compact; poor nut structure; vesicular. |
| B ₂ | 15-24
or 40" | Dark red (10R 3/6) clay, with medium to small angular nut, that breaks into very small angular nut. |
| B ₃ | | The depth varies considerably. In places it is absent; in other places, it is 2 or 3 feet thick. The color is slightly paler than that of the B ₂ . The aggregates are less distinct and larger. |
| C | | Rotten phyllite, with some quartz veins. |

We drive on up into the rolling hills above and stop near Gumeracha to look at a soil from phyllite or a very fine micaceous sandstone. This soil resembles a Gray-Brown Podzolic, a little on the dry side, and a little lithosolic. There is some suggestion of Brown Forest in it. Like all the podzolic soils I have seen in Australia, this one has relatively thin organic horizons, if indeed any at all. Perhaps this is related to something special about the eucalyptus forest.

- | | | |
|----------------|------|--|
| A _p | 0-5" | Gray to dark gray (7.5YR 5/0 to 4/0), heavy, very fine sandy loam, with some pebbles. The soil is now dry and digs out in light clods that are easily friable to soft granular. The pH is said to be 5.5 to 6.0. |
|----------------|------|--|

A ₃ -B ₁	5-10"	Transitional. Reddish-brown, lightly mottled with shades, light fine sandy clay loam. Imperfect nut. Friable with difficulty.
B ₂	10-20"	Reddish-brown, mottled with shades, clay. Medium nut, that falls into fine angular nut. Some pebbles and many rock fragments. Quite irregular in thickness.
B ₃	20-30"	Irregular transitional.
C	30"+	Brown, reddish-brown, and yellowish-brown mass of decomposing rock.

These soils are used for fruits and vegetables, and for pastures with sheep and dairy cows. There is some erosion in this area, but the farmers are now learning to cultivate and plant on contour rather than up and down the slopes.

I see several plantings of Monterey pine (Pinus radiata) for box wood. It seems to grow well here.

We then start back to Adelaide. As we come down the range, we get a gorgeous view of Adelaide -- a well laid out city.

According to schedule, I should leave in the early afternoon for Perth, but at the hotel I am told my plane is 5 or 6 hours late! So this means another night without sleep and a trip over new country in the dark. This is very,very bad, but there seems to be no help for it.



K-1657 January 24, 1949
 South Australia. 19 miles northeast of Adelaide.
 Landscape on Red Podzolic soils (?). Eucalyptus
 (leucoxylon) trees with bracken and grass beneath.
 Another view.



K-1658 January 24, 1949
 South Australia. Near Forest Range in hills east of
 Adelaide. Mixed farming with fruit on Gray-Brown
 Podzolic soil.

Mr. Stephens takes me over to the zoological garden to see the koala bears and to have lunch. The bears are said to be cross on such hot days, but these seem gentle enough, only very, very sleepy. I then go out to the Waite Institute and talk some more with Taylor and Stephens. I take a little glimpse of the drafting section. Very simple methods are used for copying the field sheets onto tracing cloth.

I call the air office and find the plane is later yet and won't leave before 8:00 in the evening. Mr. Taylor takes me to the city air station, where I check my bags. I have dinner nearby, and then a long wait. We get into the bus at 7:25 for the 25-mile ride to the air strip. Just as I should be landing in Perth, I get into the plane at 8:40. It is another one of these big British overseas planes. The speed and efficiency of the crew can scarcely be said to stimulate confidence. I hope the pilot is relatively better. We are in the air at 9:16 p.m. I read and try to sleep, without success. So goes one day into another.

Mr. Stephens takes me over to the zoological garden to see the kuala bears and to have lunch. The bears are said to be cross on such hot days, but these seem gentle enough, only very, very sleepy. I then go out to the White Institute and talk some more with Taylor and Stephens. I take a little glimpse of the drafting section. Very simple methods are used for copying the field sheets onto tracing cloth.

I call the air office and find the plane is later yet and won't leave before 8:00 in the evening. Mr. Taylor takes me to the city air station, where I check my bags. I have dinner nearby, and then a long wait. We get into the bus at 7:25 for the 25-mile ride to the air strip. Just as I should be landing in Perth, I get into the plane at 8:40. It is another one of these big British overseas planes. The speed and efficiency of the crew can scarcely be said to stimulate confidence. I hope the pilot is relatively better. We are in the air at 9:10 p.m. I read and try to sleep, without success. So goes one day into another.



1,000,000
WAC-1352

1,000,000
WAC-1460

19- Perth 1: 5,000,000

January 25

We put our watches back an hour and a half, and then about 1:00 a.m., people begin to get ready to leave the plane. We are down at the airport near Perth at 1:15, and I am met by Mr. G. H. Burvill of the Department of Agriculture and Mr. C. J. Russell. They drive me to the Hotel Esplanade and I go to bed very tired at 2:10 a.m.

And then I am up again at daylight for an early cup of tea. I read the West Australian, Perth's morning newspaper, while I wait for the dining room to open at 8:00. It apes the London Times by having the classified ads on the front page. Perth is very isolated; in fact, only a relatively short time ago, the people of Western Australia, in referendum, voted to secede from the Commonwealth. But London took no notice of it.

Breakfast is over at 8:45. I send out a suit for pressing, pack, and I am waiting for my guides at 9:00 a.m. It is exceedingly difficult to get started in the morning in Australia. They come at 9:15. I check my reservations at the air station, and we drive toward Freemantle on the north side of the river. At the right of the road are cliffs of calcareous sandstone, well cross-bedded. I am told that Perth has 36 inches of rain, with a wet season from May to October. There is very little frost near the coast, but some inland.



CS-DP-
PERTH RADIO
325 VZPH

(Joins 1351) (Joins 1352)

MAYLANDS
6 L 30
PERTH

FREMANTLE
30 sec 72.9

Robert Point
Safety Bay
Becher Point
Murray River

Wellard
Mundijong
Serpentine
North Dandalup

Pinjarra
Big Lake
Lake Clifton
Lake Hartley
Lake Preston

Waroonah
Yarloop
Preston
Harvey

Benger
Brunswick Junction
Farnbrook
Picton Junction
Dardanup

Boyanup
Wellington Mill
Capel
Donnybrook
NEEDLES HILL

Kirup
Balingup
Greenbushes
WHINSTON HILLS
HESTER HILL

Yornup
Yanmah
Manjimup
Jardee
Eastbrook

Pertherton
Warren River
Northcliffe
MOUNT CHUDALUP
Lake Maringup

Sandy Island
Broke Reefs
Cliffy Head
Chatham Island

Point Nuyts
Goose Island
Point Irwin
Foil Bay

Point Hillier
Wilson Head
Knapp Head
Tennessee

Redmond
ALBANY
225
Marbellup

Grove Hill
Stony
Bald Head
FI (U) 3 sec 60

King George Sound
Cape Two
Angove Lake
MO MAN 18

Warburton Lake
Lake Corinup
Napier
Kalgan
Woolenellup

Mount Barker
Porongurups
Morande Lake
Narrikup
Lake Barnes

Mount Katmerndyup
Barrow Lake (Salt)
Mortgallup
Kendenup
Wansbrough

Pootenup
Hamilla Hill
Balicup Lake
Swan Lake
Salt lakes

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

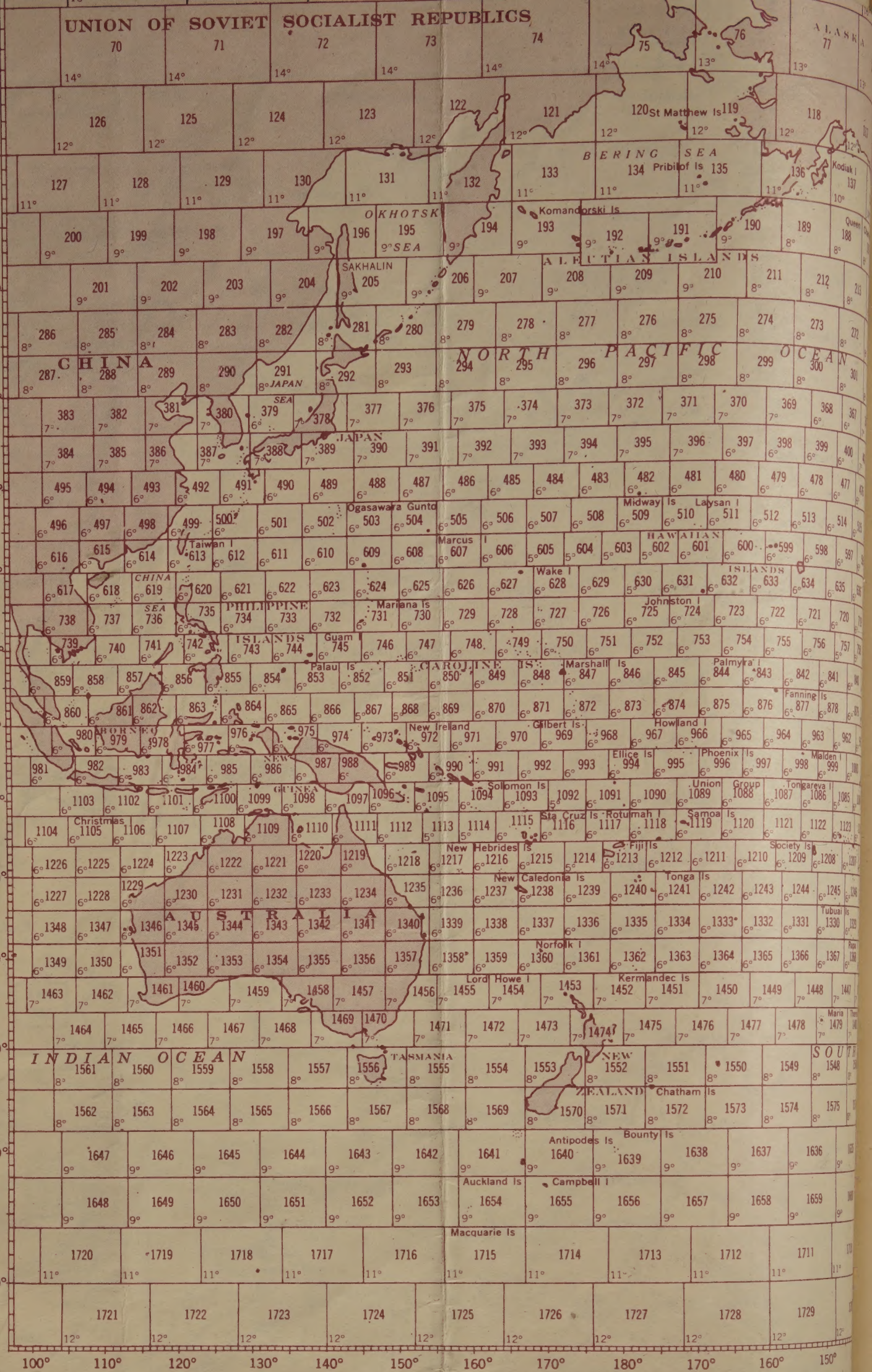
Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

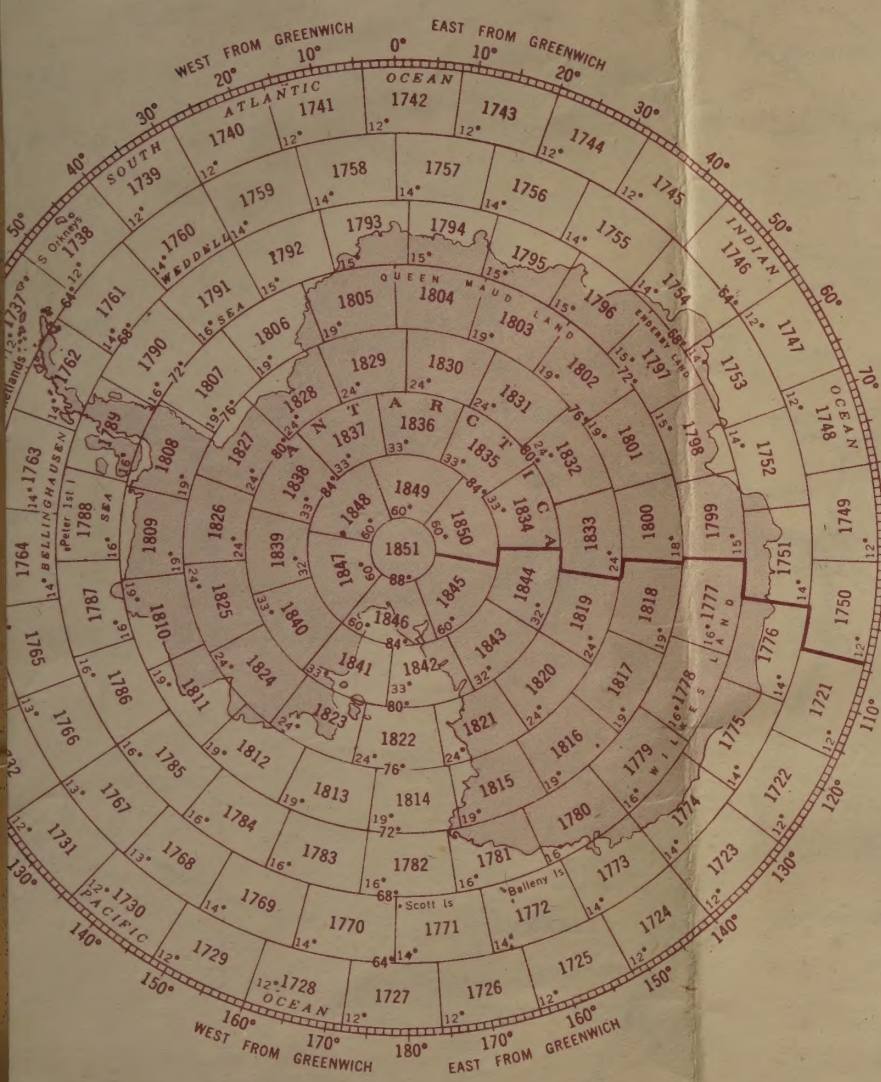
Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake

Barracup Lake
Salt lakes
Balicup Lake
Pootenup
Hamilla Hill

Wansbrough
Pootenup
Hamilla Hill
Balicup Lake
Swan Lake



SOUTH POLAR AREA



WORLD AER

AERONAUTICAL SYMBOLS

AERODROMES

TS—COMPLETE FACILITIES Refueling complete repairs, shelter, and (where applicable) passenger or cargo services and/or seaplane hauling-out facilities.

AIRFIELDS—LIMITED FACILITIES Refueling services for normal traffic and limited repair facilities.

- LANDPLANE**
- Military Base
 - Civil
 - Joint Civil and Military Base

- SEAPLANE LANDPLANE**
- Military
 - Civil
 - Joint Civil and Military

LANDING GROUNDS and ANCHORAGES

- Emergency Landing Ground with Landing Strip—Very limited or no facilities or complete information not available
- Emergency Landing Ground—Very limited or no facilities or complete information not available
- Sheltered Anchorage—Very limited or no facilities

AIRFIELD DATA

- 300 Elevation in feet
- Minimum lighting; obstruction, boundary or runway lights, aeronautical light and lighted wind indicator

- Radio Range (With voice)
- Radio Range (Without voice)
- Non-Directional Radio B (With voice)
- Non-Directional Radio B (Without voice)
- Marine Radio Beacon
- Radio Direction Finder (With voice)
- Radio Direction Finder (Without voice)

SKYVIEW 300 LH 60

We drive by some nice gardens and into the grounds of the University of Western Australia. This is supported by the Government and with some endowment. There are no fees for tuition. We drive north through plantings of Eucalyptus gomphocephala (tuart), Eucalyptus calophylla (marri), eucalyptus Casuarina, and Banksia. The woodland is thin with an understory of small palms and grasses. Some of this grass is an introduction of the South African veldt grasses. Locally, this vegetation is called "sclerophyll woodland."

I had supposed we were starting on our trip, but this was simply to kill time! We need to go back in order to wait for Mr. Robert Smith of the CSIR! He finally comes a little after 10:00, and we start on the road to Kenwick. The day is cloudy, warm, and humid, and now it rains a bit, very gently.

Most of the land near the edge of the city is yellow sand. I suspect both Ground-Water Podzols and Gray Hydromorphic soils in the imperfectly drained flats along the river. The upland consists mainly of old stratified dunes of this yellow sand.

At the edge of the city, I see a light gray sandy soil like the St. Lucie of Florida. The surface is

We drive by some nice gardens and into the grounds of the University of Western Australia. This is supported by the Government and with some endowment. There are no trees for shelter. We drive north through plantings of Eucalyptus gomphocarpus (tree), Eucalyptus calophylla (tree), Eucalyptus g var, and Podocarpus. The woodland is thin with an understorey of small palms and grasses. Some of this grass is an introduction of the South African veldt grasses. Locally, this vegetation is called "sclerophyll woodland."

I had supposed we were starting on our trip, but this was simply to kill time! We need to go back in order to wait for Mr. Robert Smith of the GWR. He finally comes a little after 10:00, and we start on the road to Kewdale. The day is cloudy, warm, and humid, and now it rains a bit, very gently.

Most of the land near the edge of the city is yellow sand. I suspect both Ground-Hater Podocarpus and Gray Hydromorphic soils in the imperfectly drained flats along the river. The upland consists mainly of old stratified dunes of fine yellow sand.

At the edge of the city, I see a light gray sandy soil like the St. Ives of Florida. The surface is

billowy; the cover is heath-like with *Banksia* shrubs, Myrtaceae (?), and Odenathos (woolly bush). Locally, the soil is called Muchea sand.

A ₀	$\frac{1}{4}$ -0"	Loose, brown, raw mulch.
A ₁	0-3"	Gray (salt-and-pepper), relatively coarse sand, with raw humus.
A ₃	3-12"	Transitional.
C	12-36"+	Nearly loose white sand, with some brown staining.

A little further on I see a deep cut in this soil. At 6 to 10 feet, there is a layer of mottled reddish-brown and yellowish-red, rather weakly indurated nodular ortstein, with yellow and gray sand beneath.

I am told that most of the soils south of Perth are exceedingly deficient in phosphorus. We pass onto old terraces along streams coming in from the southeast with yellowish clays and a developed brown surface soil. These are used for market gardening -- beans, mellons, and the like.

We pass Kenwick. I notice that the yellow alluvial clay is also used for bricks. I see some nice-looking vines, both table and wine grapes. We pass a few small citrus orchards. Many of the farms are small with poultry, vegetables, orchards, and dairying. Just east of us, as we drive south, is a bold scarp of Precambrian rocks. This



K-1659 January 25, 1949
 West Australia. Near Perth. Ground-Water Podzol
 similar to St. Lucie sand. (Locally: Muchea sand.)
 Note nodular ortstein at 6 to 10 feet. (Mr. R. Smith)



K-1660 January 25, 1949
 West Australia. Near Perth, $4\frac{1}{2}$ miles south of Gosnells.
 Quarry pit of re-indurated, lateritic gravels in old
 colluvial fan. (Site of sample No. 10)

shield is very old and stable. We cross the bed of the Canning River. There is quite a bit of citrus here, some good and some poor.

We pass Gosnells. I see some patches of shallow podzolized sand over the alluvial clay. Most of the land here has very thinly wooded pastures (dry now), with some nice orchards and gardens in favored places. Four miles south of Gosnells, we are up on a talus slope from the old scarp. Along here I see some stone fruits.

Four and a half miles south of Gosnells, I stop to look at the soil in a large pit. The slope of this old fan is about 3 or 4 percent. Originally there may have been rather good forest with only a little grass underneath. The rainfall is said to be around 30 to 40 inches. It comes mostly in the wintertime, so there is summer drought. The soil is used for crops and I see several fair wine vineyards. The land is well drained.

Locally this soil is said to be similar to the Forest Grove series. The parent material is old pisolitic laterite, probably laid down in Tertiary times. Now a podzolic soil is developing on the old fans from this laterite -- probably formed in a Ground-Water Laterite. The surface has a fair erosion pavement of medium and coarse gravel.

Sample No. 10

A ₀	1/8 or 1/4-0"	Very dark gray, dry, brittle organic matter with a bit of sand. (5YR 4/1 - dark gray)
A ₁	0-1/2"	Light gray gravelly sand. (5YR 5/1 - gray)
A ₂	1/2-10"	Pink loamy gravelly sand. (The gravel is laterite.) (7.5YR 7/4 - pink)
A ₃	10-28"	Reddish-yellow (7.5YR 7/8), gravelly light sandy loam. Firm in place, but digs out easily as a loose mass. (7.5YR 7/6 - reddish-yellow)
C _c	28-72"+ (C _c (1) at 35") (C _c (2) at 72")	Mottled red and yellowish-red (and shades) hardpan of laterite. More fragile than some, but still hard. With depth, the amount of white in the mottling increases. Pisolitic, but not extreme; somewhere between hard laterite crust and cemented concretions.

Likely there is granite at great depth.

My guides tell me that this soil, and very similar ones, dominate the agricultural part of the region. ^{1/}

As we drive south, I see a few patches of reddish-brown soil associated with exposure of "rather basic country rock" -- shales, schists, and the like.

We pass Armadale. The pastures with annual species are now dry and nearly useless (yet today it is still trying hard to rain). I see a lot of wild land with thin woodland, shrubs, and very thin grass. There are also thinly wooded

^{1/} See also, for southern Australia generally, CSIR Bulletin 206 (1946), Pedogenesis following the dissection of lateritic regions in southern Australia, by C. G. Stephens.



K-1758 January 25, 1949

West Australia. Near Perth, $4\frac{1}{2}$ miles south of
Gosnells. Soil developed from old lateritic gravels
(similar to local Forest Grove type). (Sample #10)

pastures, which are used some now, mainly for cattle. Both kinds of pasture are on the soil described above.

A little way beyond Armadale, we come out on a nearly level, undulating to gently rolling, outwash plain. It extends from the hills to the east. The soil here is developed from the old lateritic gravels and sand. The colors are generally yellowish-red. There are patches of white sandy soil over the laterite, likely from old dunes laid down in a more arid period just before modern times. It would seem reasonable to me to consider the laterite here as parent material in a similar status to any other rock, although certainly there has been some recementation after deposition of the material by water.

I pass one field with contour furrows.

We see a few small drifts of soil material blown into fence rows by the strong early morning east winds, characteristic of this area.

We pass Serpentine on a gently undulating plain with patches of the white sand over the laterite. (I suspect now that my guides have planned too long a route and we won't be able to stop much.) There is some new settlement in this area, using the land for dairying and for fattening cattle in the spring season. Certainly this is a difficult soil, although, of course, much better than the true

Ground-Water Laterite. Phosphate is required in rather large amounts. Pastures are given 118 lbs. of 22 percent superphosphate every year. I am told that "a good soil in Western Australia is one needing only phosphate fertilizer." Further south of us, copper and cobalt deficiencies are reflected in the conditions of the animals. Zinc and manganese deficiencies are also common, as well as molybdenum. The latter has even given increases on the cauliflower in this area. Potash is needed on many pastures, especially where they are cut fairly often for hay.

In developing the pastures here, the trees are ring-barked or pushed over with a bulldozer. A few green trees are usually left for shade. Most fields have many dead snags and logs. Lately, subterranean clover is widely used.

Eight miles south of Serpentine, large areas have the gray sand smear over the laterite gravels. In deep road cuts one sees the reconsolidated laterite gravel in huge masses. Here I see quite a few cattle, but very few sheep. Around here there are a few low (6 to 12 inches) gray termite mounds.

(Right now I see a load of superphosphate going into a farm. It is put up in 12 bags to the ton. I note that this batch is "copperized.")

Ground-Water laterite. Phosphate is reported in rather large amounts. Pastures are given 118 lbs. of 22 percent superphosphate every year. I am told that "a good soil in Western Australia is one needing only phosphate fertilizer."

Further south of us, copper and cobalt deficiencies are reflected in the conditions of the animals. Zinc and manganese

deficiencies are also common, as well as molybdenum. The latter has even given increases on the canillower in this area. Potash is needed on many pastures, especially where they are cut fairly often for hay.

In developing the pastures here, the trees are ring-barked or pushed over with a bulldozer. A few green trees

are usually left for shade. Most fields have many dead snags and logs. Lately, subterranean clover is widely used.

Eight miles south of Serpentine, large areas have the

gray sand smear over the laterite gravels. In deep road

cuts one sees the reconsolidated laterite gravel in huge

masses. Here I see quite a few cattle, but very few sheep.

Around here there are a few low (6 to 12 inches) gray laterite mounds.

(Right now I see a load of superphosphate going into a farm. It is put up in 12 bags to the ton. I note that this

batch is "copperized.")

As we drive south, there are several large, nearly flat areas that are imperfectly drained.

We pass Pinjarra and cross the Murray River, which has broad terraces along it with brown soils that are apparently of good quality. The pastures are very dry now, but are used for fattening cattle in the spring, and a few sheep are grazed. Five miles south of Pinjarra, the higher terrace also has some thin smears of billowy dune sand, some yellow and some white.

A bit further on, I look hurriedly at the soil.

- | | | |
|----------------|--------|--|
| A ₁ | 0-3" | (Disturbed) Light reddish-brown clay loam. Vesicular. Fairly easily friable. |
| A ₃ | 3-8" | Reddish-yellow clay loam. Vesicular. Massive, but easily friable. |
| B ₂ | 8-15" | Red (2.5YR 5/8), mottled slightly with light red, clay. |
| B ₃ | 15-30" | Brownish-yellow, fairly friable clay. Massive in place, but digs out easily. Very indistinct nut structure. |
| C | 30-48" | Mottled reddish-yellow and light red, moist, friable clay with reticulate mottling. The red increases slightly with depth and some olive-yellow appears near 48 inches. Part of the material is gritty and all of it is plastic when worked. |

The land is nearly level, with a few low swales and low ridges with sandy surfaces. The original forest was



K-1661 January 25, 1949

West Australia. 5 miles south of Pinjarra. Ring-barking of trees on good brown soils on the terraces of the Murray River.

heavy. This is good soil for pasture. Most of this land was taken up in the early days and the present owners still use it for pasture, although it likely could be used for crops. At other places along the road, the soil has more red in the solum.

(The flies are very bad here too!)

We come to Waroona, have a light lunch, and go on again at 2:30. We drive south on a coastal terrace, mostly of laterite gravels with patches having a sand covering.

We pass Yarloop. The land here is mostly forest, with some grass and shrub ground cover. Part of this area is in a government forest reserve. We soon come to somewhat more rolling, foothill land. The uplands are thin woodland used for grazing and there is some irrigation in the lowland areas.

In the Harvey River valley there are some citrus orchards on the terraces, but most of the land is in pasture. A little crop land is irrigated. The soils are quite heavy.

As we pass Harvey, we are back again on the upper coastal plain from the lateritic material and with the sand covering.

We stop in an area of Ground-Water Podzol with heavy, deep, but irregular ortstein, superficially resembling the reticulately mottled laterite. But it is sand cemented partly with organic matter and partly with iron.

In a little way we are on terraces with brown soil rather rich in clay. It is planned to irrigate part of this soil. Some of it will pose a serious drainage problem. It is intended to use flood or border irrigation for pastures and meadows in summer.

About 7 miles south of Harvey there is somewhat more cropping. I see potatoes and pumpkins, but most of the land is used for dairying. In irrigated pastures, the cover is paspalum grass, white clover, and rye grass. The soils are too heavy and too wet in the winter for alfalfa.

Just south of Brunswick Junction I see a large field just going into potatoes, which will be irrigated. This is brown soil developed from the yellowish alluvial clay, probably like the one looked at earlier.

As we go up to the higher terrace level, the soil is red in the well-drained places near the stream channels; and on the nearly level places, it is reddish-yellow beneath the brown surface. About 6 miles south of Brunswick Junction, we cross a large, flat area of reddish-brown soil from heavy, yellow alluvium that is partly irrigated. Special drainage is necessary here also.

Still on the big flat of yellowish alluvial clay, we turn south towards Dardanup. Most of the land is in pastures, many of which have very thin stands of trees.

In a little way we are on terraces with brown soil rather rich in clay. It is planned to irrigate part of this soil. Some of it will pose a serious drainage problem. It is intended to use flood or border irrigation for pastures and meadows in summer.

About 7 miles south of Harvey there is somewhat more cropping. I see potatoes and pumpkins, but most of the land is used for dairying. In irrigated pastures, the cover is paspalum grass, white clover, and rye grass. The soils are too heavy and too wet in the winter for alfalfa.

Just south of Brunswick Junction I see a large field just going into potatoes, which will be irrigated. This is brown soil developed from the yellowish alluvial clay, probably like the one looked at earlier.

As we go up to the higher terrace level, the soil is red in the well-drained places near the stream channels; and on the nearly level places, it is reddish-yellow beneath the brown surface. About 6 miles south of Brunswick Junction, we cross a large, flat area of reddish-brown soil from heavy, yellow alluvium that is partly irrigated. Special drainage is necessary here also.

Still on the big flat of yellowish alluvial clay, we turn south towards Dardanelle. Most of the land is in pastures, many of which have very thin stands of trees.

Most of the irrigated pastures are plowable. I also see some vineyards. I am told that it is planned to irrigate a great deal more after the completion of a dam on the Collie River.

Near Boyanup there are quite a few wine grapes, but still dairying is most important. Beyond Boyanup, we turn southeast and drive up the Preston Valley. We are still on the large plain used partly for cattle and some for fruit. Many of the fruit trees do not look thrifty. At 2 miles, we come into gently rolling soil, apparently developed from the laterite material with varying depths of yellow and white sand smears. The alluvial area northeast of the road is narrow and used mainly for fruits, apples, citrus, and others. Only a small part of the sloping soil from the laterite is cultivated. Most of it is in woods. There is a good deal of soil here like Sample No. 10, along with the irregular, narrow terraces having red soil used for fruit. Here the fruit looks quite good. Although not irrigated, it is carefully cultivated. Rainfall is about 43 inches, with long, rather dry summers. There is still quite a bit of this good red soil of the terraces now in forest. It is available for settlement. We pass Donnybrook, a pleasant village, on the way to Kirup. This takes us into strongly rolling, forested country with small valleys having red or

reddish-brown soils on narrow, irregular terraces that are used for fruits and vegetables. Most of the farmers here are of Italian origin. Large areas of forest have been ring-barked to give ghost-like stands of dead, gray snags. Five miles beyond Donnybrook, most of the land is forest with only a few spots of fruits and dairying.

We pass Kirup, a sawmill town. We are now gradually getting into country with more summer rain and with bigger trees in the original forest. Just before Balingup, there are again pastures for dairy cattle. Beyond Balingup, there is a lot of strongly rolling pasture land. Here the bracken fern is a serious weed. The soils are mainly red ones from primary rocks, but on the higher places are soils from the old fossil laterite. About 2 miles beyond Balingup, we come onto ungrazed forest. The soil is very stony with huge laterite boulders.

We stop 3 miles south of Balingup to look at a rolling Lithosol developed from the pisolitic laterite. The soil is much like sample No. 10, but with less red in the lower part. There are boulders on the surface and large masses of reindurated laterite pebbles.

Sample No. 11

I take a sample of this dense material -- mottled brownish-yellow and reddish-yellow -- which is said to be



K-1662 January 25, 1949
West Australia. 3 miles south of Balingup. Forest
on bouldery soil from old laterite, over granite.
Note how large trees pushed lateritic boulders to surface.



K-1663 January 25, 1949
West Australia. 3 miles south of Balingup. Lithosolic
soil developing from old, bouldery laterite.

typical of the Western Australian laterite. At 2 to 3 feet is reddish-yellow clay, mottled with shades. It is hard in place and gradually merges into rock. There is said to be granite at about 15 feet. Where exposed to the sun, the boulders are reddish-brown to dark red.

It is interesting to notice how the big trees here have rings of boulders around them that they have pushed up and to the side in growth.

Like sample No. 10, the soil is podzolic, developing from the old laterite. It is a little difficult to tell whether the crust here is due to reinduration, or whether this is an old Ground-Water Laterite rotting in place. Although from a strictly genetic point of view this is a podzolic soil with laterite as the parent material, the chemical characteristics of the soil, important to management predictions, are more like those of the Latosols than those of the Podzols.

About five miles beyond Greenbushes, an old tin-mining town, we leave the forest and enter strongly rolling red soil used for pasture. Originally, this area was forested. The soil resembles a Reddish-Brown Latosol, except that it is a bit too red. Where I look at it, I may be seeing the normal soil for the region, but I am not sure. The higher elevations have the influence of the old laterite.

- | | | |
|----------------|--------------------|--|
| A ₁ | 0-7" | Dark reddish-brown (2.5YR 3/4), heavy very fine sandy loam to clay loam. Very easily friable to soft, fine granular. |
| A ₃ | 7-10" | Transitional. |
| B ₂ | 10-30"
(24-48) | Dark red (10R 3/6) clay. Angular, medium blocky. |
| B ₃ | 30-
(48-60)" | Red (10R 4/8) clay. Imperfect, coarse blocky. |
| C | (48-60)-
120" + | Mottled red, reddish-brown, and reddish-yellow clay with inherited schistose structure. |
| D | | Boulders and strata in depth of schist that is variable in basicity. |

All the horizons are extremely variable, partly because of slump and the uneven hardness of the rock.

We pass Bridgetown at 6:00. Altogether too much driving has been planned for one day, considering our very late start. Then too, I am the only one with soiled cloths and dirty hands.

I wonder if the eucalyptus does not have a special influence here on iron reduction? The organic layer is always thin, partly due to fires every 2 or 3 years. There appear to be few, if any, active earthworms or similar animals, except for the termites, that would be expected to mix the organic matter with the upper mineral soil.

Road cuts expose kaolinitic clay only some 2 or 3 feet below the laterite. I see a few slag-like fragments in this mottled yellow, reddish-yellow, and white clay.

We pass Palgarup, a small timber village. It is raining and getting dark. There is an irregular forest on the gently rolling upland, mostly from the fossil laterite. Some areas have smears of sand, especially in the low places. Then at 2 or 3 miles there is some ring-barked grazing land. Just before Manjimup, there are a few scattered fields besides the grazing land.

I make a quick change in a little hotel in Manjimup. We are far too late for the hotel dining room, so go to a "greasy spoon" up the street a ways. Immediately after supper I am ready for bed in delightful coolness and under the patter of raindrops. Certainly I should sleep this night, despite the noisy party down the hall.

January 26

I am up early on a rainy morning. I shall try my very best for an early start this day. Likely we shall need to get breakfast along the road. These small Australian hotel keepers are generally arrogant and quite indifferent to the welfare of their guests, since their greatest profits come from the saloons, one of which, unfortunately, is associated with each hotel.

We leave at 6:20 a.m. without breakfast and drive south and east.

I see a few small tobacco farms. Most of the tobacco is allowed to go to seed.

We then drive south into a forest of karri eucalyptus (E. diversicolor). The trees are about 3 to 7 feet d.b.h. and some 250 feet tall. The wood is very hard. This is the largest forest tree in Australia^{8*/} and seems very big here. Much of this land is in the State forest. I see a few small new farms being made by ring-barking these large trees, which seems a pity. The soils are undulating to strongly rolling and developed from laterite materials. There are small terraces and alluvial valleys.

I look at the soil about 13 miles south of Manjimup. Here the rainfall is about 50 inches and the summer droughts are not very severe. The land is strongly rolling. Likely



K-1664 January 26, 1949
 West Australia. 13 miles south of Manjimup.
 Karri (E. diversicolor) forest on Red Latosol (?)
 from metamorphosed granite.

the underlying rocks are metamorphosed granite. The cover is this karri eucalyptus with an undergrowth of small shrubs, bracken, and a very little grass. There are some erratic fragments of old laterite to be seen.

The whole soil is relatively pervious. It is probably best called a Red Latosol.

The soil has a thin A_0 and a very thin A_{00} , altogether about 1 to 2 inches thick.

A_1	0-1 or $1\frac{1}{2}$ "	Dusky red, softly granular, gritty loam.
A_2	$1\frac{1}{2}$ -24"	Red, very friable, granular, gritty, heavy loam, with many small concretions, becoming more nearly clay loam in the lower part.
A_3	24-50"	Light red, mottled with shades, clay. Roughly coarse blocky structure, with some vertical breakage. Cracks about $\frac{1}{4}$ inch wide, now when the soil is relatively dry. Fairly easily friable; some concretions.
C	50-60"+	Mottled red and yellowish-red clay. Massive, with irregular coarse blocky breakage. Fairly easily friable. Some pores.

The soil is said to be a very high fixer of phosphates.

We drive back north over the same road and turn east a little bit below Manjimup in the direction of Mount Barker. There is still light rain at 7:30. I see a few small farms at first, and then we enter rolling forested land. Most of

the soils are developed from old laterite material that has been moved around a bit, as we saw yesterday. In the road and in the cuts, there is a good deal of laterite gravel. The forest contains a good deal of jarrah eucalyptus (E. marginata) that makes good lumber. A few farms I see are mainly devoted to stock, based on pastures made by ring-barking. In the comparatively narrow valleys there are some small apple orchards. A great deal of the land is in second-growth forest and looks to have as good soil as that already used for crops and pasture. Most of the road cuts exhibit underlying reddish-yellow or yellow clayey materials.

At 6 miles east of Manjimup, I photograph a farm having both apples and sheep. Further on, I see quite a bit of ring-barked pasture used mainly for dairy cattle. I am told that only a little feed-grain is brought into this area. The soils, like those seen yesterday, are developed from the old laterite materials. Places have smears of sand and other places have many laterite boulders.

We pass the turn-off to Deeside Homestead. Most of this soil -- the Bangalup soil -- is in forest.

Just now several kangaroos cross the road.

A few miles beyond, the forest is poor; the rainfall is lower; there is more grass in the ground cover; and the land is used for extensive sheep grazing.

I look at the soil near the northern edge of Lake Muir -- a brackish lake. I combine this soil examination with a pause for billy tea. Here is a complex of old laterite material and sand, locally called the Orongorup sand. There is a large, nearly flat area, partly imperfectly drained and partly swampy. In this situation the genetic processes of the Ground-Water Podzol are going on, complicated by a lateral movement of iron and a rather high salt content in places. In some of the associated clay flats, there are gypsum crystals.

Sample No. 12

A ₁	0-3"	Dark reddish-brown, humus-rich sand. (5YR 4/2 - dark reddish-gray)
A ₂	3-6"	Pinkish-white sand with reddish-brown mottling. This contains some fragments of hardened, nodular iron-stone. (7.5YR 8/2 - pinkish-white)
C - G	6-12" ⁺	Grayish, mottled with reddish-brown, sand, rich in nodular bog iron. (Matrix: Approx. 7.5YR 6/4 - light brown.) (The concretions of the A ₂ are collected separately as 12 special (1).)

Nearby, in a slightly lower place, the ironstone exists as a nearly continuous sheet under 2 to 4 inches of the A₁



K-1665 January 26, 1949
 West Australia. 16 miles east of Manjimup. Farm
 with apples and sheep on soils developed from fossil
 lateritic materials.



K-1666 January 26, 1949
 West Australia. Near Lake Muir. Vegetation on
 imperfectly drained soil with ironstone. "Paper bark"
 trees and Melaleuca (sp.) shrub. (Site special sample
 with #12) (Mr. Burvill).

and a smear of $\frac{1}{4}$ to 1 inch of the A_2 . This ironstone is vesicular and dark purplish-red, reddish-brown, and reddish-yellow. Special sample (2) is taken of this pan.

The vegetation consists of shrubs, including Melaleuca (sp.), and low trees called locally "paper-bark trees."

This area will be included in the Mount Barker-Lake Muir soil survey now in progress.

We drive east over a somewhat better drained sandy area with deep white sand. The soil is called Nabagup sand. Here the A_1 has been deepened by deposition until it is 6 to 8 inches thick. Beneath, is nearly white sand for 3 to 5 feet. This is underlain by the black organic pan, like that in the Leon of Florida or sometimes deep in the St. Lucie. Generally, this pan rests directly on plastic, mottled yellowish-brown and gray sandy clay.

We drive on east over undulating, shallow soils from the fossil laterite.

I see several more kangaroos.

This soil is called Bangalup gravelly sand or Bangalup gravelly sandy loam.

After we cross the Frankland River, I notice again soils with smears of gray sand over the laterite.^{9*} These are called Frankland sand. This soil occurs on the tops of the divides,

with the Bangalup soil on the slopes. The rainfall is said to be about 30 or 33 inches. Comparatively, this is good land for development. It can be used for dairying and fat stock, and for apples in the favored places. Subterranean clover is used in the pastures. Almost all the land needs superphosphate.

About 20 miles east of Lake Muir, I stop in the rain to examine very hurriedly a profile of Bangalup gravelly sand described by Carroll and Jones in Soil Science.^{1/} The soil is said to be only slightly acid.

The slope is about 4 to 6 percent. The cover is thin forest. There is no regular iron pan in the profile, but there are a few laterite boulders. This is a weakly podzolized soil on the old laterite materials. The material from which the solum is developed may have been moved; but the lower part is developed directly from the fossil laterite. Likely we should need to include it with the Red-Yellow Podzolic (from lateritic materials).

There is very little A_{00} or A_0 .

A_1	0-1 $\frac{1}{2}$ "	Very dark brown to black loamy gravelly sand. Rich in humus. Granular.
-------	---------------------	--

^{1/} See: Carroll, Dorothy and Jones, Neal K. Laterite developed on acid rocks in southwestern Australia. Soil Science 64:1-15. (Said to have abundant gibbsite in the material between 22 and 40".)

with the Bangalup soil on the slopes. The material is said to be about 30 or 35 inches. Comparatively, this is good land for development. It can be used for dairying and for stock, and for apples in the favored places. Submergence of water is used in the pastures. Almost all the land needs superphosphate.

About 20 miles east of Lake Murr, I stop in the rain to examine very hurriedly a profile of Bangalup gravelly sand described by Carroll and Jones in Soil Science. The soil is said to be only slightly acid. The slope is about 1 to 5 percent. The cover is thin forest. There is no regular iron pan in the profile, but there are a few laterite boulders. This is a weakly podzolized soil on the old laterite materials. The material from which the column is developed may have been moved; but the lower part is developed directly from the fossil laterite. Likely we should need to include it with the Red-Yellow Podsolite (from laterite materials).

There is very little A_{20} or A_{30} .

A_1	0-1 1/2	Very dark brown to black loamy gravelly sand. Rich in humus. Granular.
-------	---------	--

1/ See: Carroll, Burt and Jones, Neal R. Laterite developed on acid rocks in southwestern Australia. Soil Science 21:1-15. (Said to have abundant globulite in the material between 22 and 40".)



K-1760 January 26, 1949

West Australia. 20 miles east of Lake Muir. Profile of Bangalup gravelly sand. (Described in Soil Science by Carroll and Jones.) Weakly podzolized soil on old lateritic materials.

- | | | |
|----------------|---------------------------------|--|
| A ₂ | 1 $\frac{1}{2}$ -15"
(12-18) | Reddish-yellow (7.5YR 6/6) sandy loamy gravel. Firm in place, but digs out easily as a loose mass. |
| A ₃ | 15-30"
(24-36) | Like the above, but somewhat more compact. |
| C ₁ | 30-42" | Mottled yellow, gray, and red clay. Heavy and kaolinitic, but with some cracking. |
| C ₂ | 42-48"+ | Mottled red and yellowish-red clay. Massive, but cracks into large blocks. |

We drive east in the rain over much of this soil. A lot of it is used for sheep pasture. These pastures require fertilization with copper as well as with phosphate. Pine plantings require zinc.

About 15 miles west of Mount Barker, we pass a prison farm. East, there is some farming -- mostly pasture developed with ring-barking.

It still rains. Even with the early start, we are again running behind. No time was allowed for profile examinations.

A little further on, in the upper part of the Hay River Valley, I see some good rolling soil from dark-colored country rocks, lower in elevation than the fossil laterite. But there is no time to examine them. Yellow-Brown Latosol?

We then are back on the gravelly lateritic soils with apples, sheep, and cattle. There is quite a bit of forest on land of the same quality as that farmed. Some of the newly cleared land has been prepared for pasture with

bulldozers, at a cost of about 8 pounds per acre. All but a few big trees can be knocked down and burned. I see a good bit of clearing being done, mostly by local residents to increase the size of their own units.

We pass Mount Barker at 12:30. Here the rainfall is 30 inches. I am told that there is a problem here of increasing salinity of ground water after clearing. Some of the low flats become salty. The soils are developed from laterite gravels, likely over old rocks of the Precambrian Shield. The soils are mainly of the Bangalup series except for small areas of Alluvials. The forest is mainly jarrah eucalyptus and marri eucalyptus (E. calophylla). Likely this land was originally a Ground-Water Laterite. Later, the land was dissected and drainage improved. The hardening has come about chiefly, but not wholly, by consolidation of concretions. Then, with the change of climate, podzolization has been impinged on this material. Apparently there has been some reformation of pans in Ground-Water Podzols and in transitional soils between Ground-Water Podzols and Ground-Water Laterites in the imperfectly drained places. Many of these are depressions filled or partly filled and later covered with sand smears.

As we drive north, I see many ring-barked pastures and a few apple orchards, especially on the lower slopes where the soils are developed from the country rock with only a little influence from the laterite gravel. Some of the pastures have been mown for low yields of hay that is baled and stored for use during the drought periods in late summer and early winter. I am surprised to see so little accelerated erosion.

About 10 miles north of Mount Barker, I see a great deal of pasture on the undulating to gently rolling Bangalup soils. The Alluvial soils in the narrow valleys and depressions are salty. New springs and seepy areas start here after the clearing of the forest. Then erosion may follow the development of the salty seeps. Then again, I pass through small ridges of sand over the laterite gravel. Some of these sand smears are on the upland and some in the depressions.

Fifteen miles north of Mount Barker there are many nearly flat areas with salty ground water. Surface water is caught in small dams for stock. Here the wandoo eucalyptus is dominant in the thin forest. The rainfall has dropped to below 25 inches.

The soils on the flats here are said to be solonetz-like, partly because of poor drainage. Near Cranbrook, much

of the land is nearly level to gently undulating. We are now just at the south end of the wheat area, but most of the land is scrub or pasture. Where pastures have good stands of subterranean clover, wheat yields are said to be good following the plowing of the pasture. We then pass through a patch of very scrubby land with sand over the laterite gravels.

Many of the shrubs and trees here have an associated parasite tree with brilliant orange-colored flowers. Locally these are called "Christmas trees."

About 51 miles north of Mount Barker, we come into a high area with soils from the country rock -- granite and basic intrusives. The soil here is Kojonup, made up from these materials and some laterite gravels. The pattern of local soil types and phases is exceedingly variable. Most of the land is gently rolling. Nearly all of it has pastures, with scattered trees, which are used mainly for wool sheep. The rainfall is about 20 to 25 inches. Even here, there are patches with laterite boulders on the surface.

It is said that here sheep growers are having difficulty with infertility among ewes grazing on the green subterranean clover. It is necessary to have diversified grazing and



K-1668 January 26, 1949
West Australia. 15 miles north of Kojonup. View
on Beaufort sand, a solonetz-like soil.

avoid much of this clover. I see some oats, grown partly for grazing, partly for hay, and partly for grain.

We reach Kojonup for lunch about 2:10 p.m.

North of Kojonup, some 40 percent of the soil appears to be formed from the country rock. It is mostly used for grazing. There is some oats, and a fair sprinkling of scrub forest. I see quite a bit of new clearing to enlarge existing farms. We pass large, smooth areas with a gray sand over the laterite material. Here many poisonous plants need to be eliminated from the wild vegetation before grazing.

Beginning about 12 miles north of Kojonup, we pass over a large area of this gray sand over laterite with the thin jarrah forest. We stop about 15 miles north of Kojonup and look at a solonetz-like soil called, locally, Beaufort sand.

- | | | |
|----------------|-------|--|
| A ₁ | 0-1" | Dark gray, loamy sand. Firm in place, but easily friable. |
| A ₂ | 1-4" | Gray, faintly mottled with yellow and dark gray, loamy sand. Many holes. Very low volume weight. |
| B ₂ | 4-18" | Dark gray, mottled with yellowish-brown and light gray, hard, heavy sandy clay. Columnar structure with aggregates about 4 to 8 inches in diameter. There is sand in the upper part of the cracks. |
| C | 18" + | The soil gradually merges into mottled clay. |

This is the comparatively low part of the plain; elsewhere the A_1 is yellowish and the A_2 above the columns is gray. I suspect that this sand is a geological deposit over the clay.^{10*}/

About 20 miles beyond Kojonup, we come onto a poor undulating area of thin soil from laterite materials under thin forests.

It is curious how the salty seeps develop in the soils from lateritic concretions after clearing. Apparently grasses do not keep the soil so well desiccated as the eucalyptus trees.

We then pass through more gently rolling areas of better soil. Large parts are used for pasture in a complicated land-use pattern. Just before crossing the Beaufort River, I see a large, flat area for 3 miles of saline solonetz-like soil. Apparently the salts are increasing with the dying of the eucalyptus trees and the coming in of Salicornia. Much of this soil has a shallow covering of gray or yellow sand. Although now poor and dry, it is imperfectly or poorly drained much of the time.

We are then back onto gently rolling soil from both fossil laterite and country rock. Perhaps one-half of it is used for grazing, along with some oats. The grass is

mixed with scrubby, thin forest. The soil from the basic rocks might be Reddish-Brown Latosol. I can't be sure. A few of the middle slopes have many granitic (?) boulders. The pattern of local soil types and phases is quite complex.

At 32 miles north of Kojonup, somewhat more cultivated land is used for oats. But still most of it is grazed. All the vegetation looks dry.

(It is now warm and sunny, almost hot. Likely this area had none of the rain we drove through further south.)

Just beyond the Arthur River, the land is mostly cleared except for specimen trees and clumps in the big pastures. Some soils are red, others yellow, depending upon the local slope and rock type. But as we go north, there are more patches of the poor gravelly soils over the old laterite.

This is a long, tiring drive, and we are bound to be late again. Altogether too much useless driving was planned with no time allowed to examine the soils.

We pass Williams, then Crossman. This has been very similar country, but now we start rising a bit in elevation. I see rather poor gravelly soils from the old laterite material under relatively thin forests.

As we go up to the Darling Range beyond Bannister, the trees are somewhat larger (6 inches to 30 inches d.b.h.) and

perhaps a bit thicker. Nearly all the scrub forest is on the old lateritic material, gently to strongly rolling. I see many exposures of yellowish, massive laterite of the type described yesterday in the hills.

(Oh, how tired I am -- all this useless driving over similar country for miles and miles, and then more miles of the same! Shades of Algeria!)

I am told that railway ties cut from these forests are being sent to South Africa.

We come into the Bedfordale Valley with some fruit and grazing. I see citrus, apples, pears, and other fruits. This is a very narrow valley with the old laterite soils on the hills of either side.

We join yesterday's route at Armadale and drive into Perth. I get to the Hotel Esplanade at 6:30, just in time for a quick bath before dinner.

For some reason, the hotel management asks me to give up my room, when I paid for it last night, even though I didn't use it, just for the sole purpose of having it tonight. Finally we compromise -- if one can call it that -- by my moving to another room until my plane goes. Australia has far too few hotels and their managers and employees are little short of arrogant -- certainly more than indifferent --

with few exceptions. The similarity in attitude among people in Australia and people in France is a bit distressing. I get the impression that many Australians expect too much from too little effort. Nearly everything is in short supply, but few, except perhaps stockmen and farmers, seem to be working very hard or seem even much concerned about the drift of affairs. Of course, this impression may be wrong. My sample is too small.

The soil maps in this region are largely maps of broad associations with "detailed" maps of sample areas. These detailed sections are not so detailed, either categorically or cartographically, as the modern soil surveys in, say, Iowa or Tennessee. And I suspect that the boundaries are not traced with as much accuracy, either in the field or later in the drafting room.

Much of the country seen these last two days is pretty "hard" country. Clearing is difficult. Heavy phosphate fertilization is necessary. Minor nutrient deficiencies must be corrected. Poisonous plants must be eliminated from the pastures. There are severe summer droughts. The soil pattern is complex and many of the components are low in productivity. Salinity is induced by clearing. And much of the land is distant from markets.

Although this is "hard" country, the climate is relatively good and, with scientific methods, many more people could be settled here. In most parts, a farm unit should have 1,200 to 2,000 acres. In the higher rainfall areas, some units are only 100 to 200 acres. Near Mount Barker, they run 500 to 1,000.

I rest for a while and then go to the air station. It rains. We get into the bus, but find there is some unexplained delay. Finally we get to the airport at 11:55. I board the plane at 12:00 midnight. Thus, as I wait for the plane to leave, one day ends and another begins.

Added later:

See A regional classification of the soils of Western Australia. (Presidential address) L. J. H. Teakle. Journal of the Royal Society of Western Australia 24:123-195 (sic).^{1/} 1938.

1/ Some presidential address!

January 27

We are in the air out of Perth at 12:29 a.m. Of course, there is nothing to be seen. I read and doze until 5:45 a.m. Perhaps over 300 miles out of Adelaide it begins to get light. Somewhat over one-half of the land is laid out in fields of regular geometric patterns, with small patches of nearly black shrubs. The soil seems to be grayish-brown, with some northwest by southeast wind drifts. Probably these are the Mallee soils. Yesterday Burvill told me that the solodized-Solonetz or "solonized-brown" were considerably better for small grains than others, if there were four inches or more of friable material above the columnar B.^{1/}

We are down at Gawler Field after lots of "huffing and puffing" at 7:05 a.m. -- an hour late. This Field is 25 miles out of Adelaide. The bus takes us into Adelaide very leisurely by way of Parefield. The driver is obviously feather-bedding or "going slow" as they say here. We get to the air station about 8:30. Mr. Stephens meets me and I go to his home for breakfast and to pick up the baggage that I left there.

After breakfast and packing, I go back down town with just enough time for a hair cut before going out to the air field before 11:30.

^{1/} Added later: Where I see the Mallee soils later, they have no suggestion of solonization!

It is very hot today in Adelaide -- like central Texas on a hot day in early August.

I am in the air for Mildura at 11:59 a.m. After crossing the Lofty Range, we pass over dry-looking, rolling hills to the east of it, mostly in pasture. We are then over a large area of the "solonized-brown" or Mallee soils with local patches of old dunes and what may be spots of Solonetz. We cross over the Murray River near Swan Reach. To the east and south is a complicated plain of the "solonized-brown" soil with streaks of old dunes and some shrubs. Perhaps one-fourth of it or a bit more is cultivated; one-fourth to one-third scrubby shrubs and trees; and the rest grazing. Parts have less arable land and some parts have more. There are many small ponds for stock water, generally square. As we near Mildura, the proportion of arable fields goes down.

This is a short, but very rough ride. I suspect that most of my fellow passengers are exceedingly unhappy.

The local relief is a bit bumpy. Just before Mildura, I see mostly scrub and grass cover, with perhaps one-third bare soil, reddish-brown to yellowish-red in color. Just as we are about to land, I see many small, green, irrigated fields in favored places. I can make out a little citrus and many vineyards.

We are down at Mildura at 1:50 p.m. Here the rainfall is about 10 inches.

I am met by Mr. Baldwin, who takes me to the Grand Hotel. We then go directly to the Commonwealth Research Station of the CSIR at Marbein, of which Mr. Lyon is the director. He tells me that the settlement around Mildura began in 1887, around Marbein in 1911, and near Red Cliffs in 1919. The first areas irrigated on heavy soils have had to be drained. Grapes for drying are the principal crop along here and some of the Greek currant grapes. They have had some salinity problems here. First they tried to lead tile drains to wells in sand, but these filled up. Then in 1934, large main drains were put through to use tile at 4- to 5-foot depths. The tile are mostly unglazed, 4-inch tile, spaced 40 to 60 feet apart. The tile lead out to the main drains, and these to the flats, where the salts dry up, or perhaps to the river. The drainage cost in Mildura runs nearly 40 pounds to the acre. The first trouble was with salinity, but now they are having trouble with alkalinity. Some of the reclaimed soils have gone to pH 9.8. These soils are called the Mallee soils from the native name for the bulbous Eucalyptus shrub some 10 to 20 feet high. Also salt bush and blue bush are important. Near the station I see some low

areas that were abandoned before the big community drains. The local soil near the station is called Coomealla loam. It has the Mallee shrub with a ground cover of salt bush and blue bush.

I am told that on soils with *crouê calcaire* at only one foot, citrus does not do well.

They use up to 48 inches of irrigation water in 6 applications on vines. Some years they get by with less, say, 42 inches. Before drainage, they used about 10 inches less. Now, about 15 percent of the applied water goes out in drains. On sandier soils, this figure may go up to 25 percent. The water they are using contains about 36 to 40 p.p.m. of sodium chloride and 200 p.p.m. of total salts. It is just on the edge of boron toxicity. The river water has 2 p.p.m. of boron. They are having some difficulty with zinc deficiency on citrus and some on vines. The symptoms are not severe, but zinc improves yields and the size of fruits. This is likely general. They also have, quite generally, lime-induced chlorosis; but they have always had some and it is no worse now than earlier. A little magnesium deficiency is beginning to show on the citrus growing on sandy soils.

I examine a profile of the Coomealla loam near the station where the soil has been cultivated and irrigated. The land is very gently sloping and is planted to citrus. The soil is now moist.

- | | | |
|----------------|-----------------|--|
| A _p | 0-5" | Yellowish-red when moist and reddish-brown when dry, loam. Friable. |
| A ₂ | 5-
(12-16)" | Yellowish-red sandy clay. Faintly mottled with shades and with reddish-yellow. Plastic when rubbed. |
| C _c | (12-16)-
36" | Red, mottled with light red and pink, plastic sandy clay. Some lime. A few tiny, nearly black concretions. There are many quartz grains, mostly, but not all, rounded. |
| C | 36-84"+ | Similar to above, but with gradually decreasing lime and increasing clay with depth. At 6 feet and below are bands of lighter-colored material with much lime. |
| D | (?) | There is said to be blue clay at great depth. ^{1/} |

The material was thought to have been laid down as a marine terrace.

I look at the surface in a dry, undisturbed place. The soil is very friable, and there is no evidence whatever of any Solonetz morphology!!! Baldwin tells me that this soil does not have a columnar structure, or scarcely any suggestion of it, in this general area! I fail to see how the suggestion arose to call these "solonized-brown" soils. They might be called salinized, but certainly not solonized, unless one might be anticipating what might possibly happen many years hence! Yet from what Stephens and Burvill have told me, the group does have some solonized soils in it.

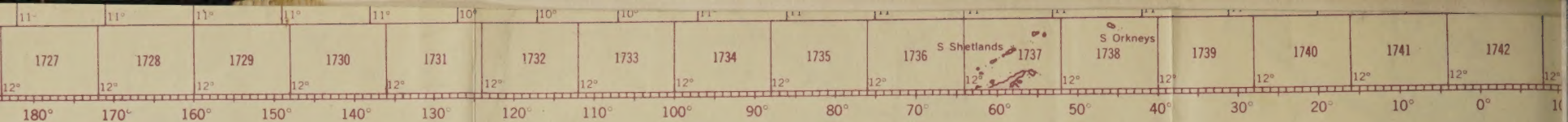
1/ Added later: This was seen later in a deep cut.

In the lower positions the soils contain more clay and lime and are rather too difficult to use. These low-lying soils are paler in color than the one described above; whereas the well-drained, sandy soils are more red. The low-lying, heavy soils have much gypsum, in bands, in the lower part. Thus, starting at the top of a sand ridge here and going down to the flats, one finds the following soils: Murray sand, Barmera sand, Barmera sandy loam, Coomealla sandy loam, Coomealla loam, and finally, Mildura loam.

I look a bit at some plots where, by growing alfalfa, the chlorosis of fruit trees, said to be due to iron deficiency, is reduced. This chlorosis is connected with a high pH and high amounts of sodium and potassium in relation to calcium and magnesium. The chlorotic shoots have a higher pH than the other twigs. They don't get much effect from nutrient sprays, except with very young leaves.

A little after 5:00 I explain to Mr. Lyon and Mr. Baldwin that I am so tired I can't write another note. I go back to the hotel at 6:00, have an early dinner, and then hope to get two nights' sleep in one.





WORLD AERONAUTICAL CHART INDEX

Scale of Series 1:1,000,000

21 Mildora 1:1,000,000
Slovakia 1945

AERONAUTICAL SYMBOLS

RADIO FACILITIES

All frequencies are kilocycles unless otherwise stated. Use of the word **RADIO**, **AIRWAYS**, **CONTROL** or **HOMER** within the box indicates "Voice facilities". **RBN** preceded by the letter **M** indicates a Marine Beacon.

Range (voice)

Range (voice)

Range (voice)

Direction Finder (voice)

Fan Marker Beacon

WOODY RADIO
291 AB

WILLOW RANGE
320 KB

BELT RADIO
109.1 mc MT

DF
MANUA HOMER
116.1 mc

ARK

Non-Directional Radio Beacon
(Without voice)

Radio Communication Station
(With voice)

Radio Communication Station
(Without voice)

Radio Broadcasting Station

International Boundary
(Closed to passage of aircraft except through air corridor)

RBN
EVERETT
224 MMC

CS
GOWEN AIRWAYS
4220

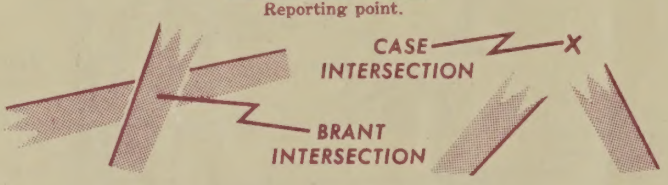
CS
KAZAN
5200 WYZW

BS
WOL
1280

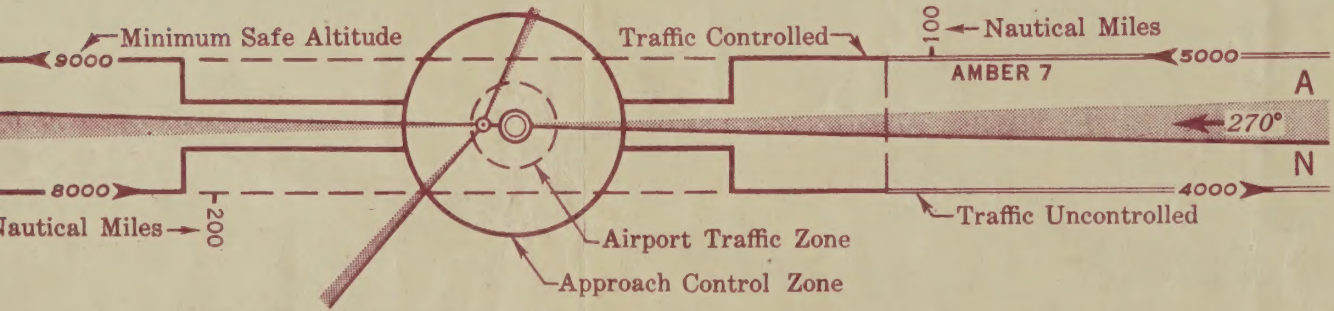
AIRCRAFT LANDING FACILITY INFORMATION

HARMON FIELD
18 LH 46
Airport of Entry
VHF / IA System
GCA System
HARMON TOWER
278 116.1 mc

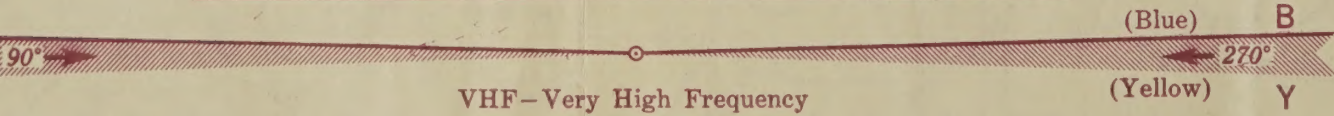
RADIO FIXES



AIRWAYS & RADIO RANGE (AURAL)



VHF TWO-COURSE RADIO RANGE (VISUAL)



VHF FOUR-COURSE VISUAL-AURAL RADIO RANGE

All bearings are magnetic at the station.



CITIES and TOWNS

- Metropolitan Areas
- Large Cities
- Cities
- Small Cities
- Large Towns
- Towns & Villages
- Contours
 - Reliable
 - Depression
 - Approximate
- Bluffs, Cliffs & Escarpments
- Swamps & Marshes
- Mud & Tidal Flats
(Exposed at low tide)
- Fathom Line (Dots uniformly spaced)
(1 fathom, 6 ft. below mean low water level)
- Danger Line (Dots grouped in pairs)
(2 fathoms, 12 ft. below mean low water level)
- Charted Rocks
- Shoals, Sand Bars, etc.
(Exposed at low tide)
- Springs
- Wells & Water Holes
- Reefs, Coral & Rocky Ledges
(Awash at low tide)
- Power Transmission Lines
- Telephone & Telegraph Lines
- Dams
- Elevations (In feet)
 - Highest in a general area
(Highest on chart is devoid of spot)
 - Spot

January 28

I am up at 6:00 with the screeching of many little lovebirds in the garden. It promises to be a very hot day.

Mr. Lyon, with his two daughters, comes for me about 8:25. We go north across the river over a small first bottom of heavy soil. A few vegetables are grown here for sale in Melbourne. These are mainly tomatoes grown under glass. There are a few vines on the slopes to the first bottom. There are some small dairy farms, and the cows look very good. We pass a big sheep pasture on the left, grazed so heavily that some of the trees are disappearing because of the increased runoff. On the Mallee soils, I see a few almonds that are a bit chlorotic. Then there are some small citrus plantings, but most of the irrigated land is in vines. I notice a little new clearing with bulldozers. Mr. Lyon tells me that previously they used heavy tractors and cables for the Mallee shrubs.

We follow along the north bank of the Murray River, and I look at the soil about 8 miles out in an old cut. Vegetation is mainly Mallee shrubs (or trees), with blue bush and similar plants. The land is heavily grazed. This place is about 90 feet above the river. The surface is gently undulating, but some gullies are working back from the river.



K-1669 January 27, 1949
Australia. Northern Victoria. 8 miles west of Mildura.
Native vegetation on Coomealla loam. Shrubs are Mallee
with ground cover of salt bush and blue bush.



K-1670 January 28, 1949
Australia. Northern Victoria. 8 miles southeast of
Mildura. Stream rejuvenation a hundred yards from the
terrace to the flood plain of the Murray River. (Accel-
erated erosion)

- A₁(p) 0-8" Yellowish-red (5YR 5/8), heavy loam to fine sandy clay loam. Irregular, coarse blocky, with irregular, vertical cleavage, easily friable to powdery, very finely granular.
- A₃ 8-24" Transitional. Yellowish-red, fine sandy clay loam, mottled with shades and lightly with pink. Digs out in irregular, imperfect, blocky, that is fairly easily friable.
- C_c 24-72" Pink, mottled with shades and a bit of yellowish-red, very limy clay. When wet this soil is said to lose all structural stability and become a sort of surry. When dry, it digs out in medium, irregular, poor blocky, fairly brittle and easily friable. Some vertical streaks.
- C 72-120" Transitional.
- C 120-160" Light olive-gray, massive clay, mottled with purplish-red. This has a faint bluish cast. When dry, the material exists in sharply angular, almond-shaped blocks.

Below the A₁ there are a few rounded pebbles throughout, and some hard, lime nodules.

I fail to see the slightest evidence of solonization. If this is a characteristic profile, and it is said to be here, of Prescott's "brown solonized soils," the name seems inappropriate.

We drive on. We pass a few fields of alfalfa for the local dairy herds. I see small patches of the marrow-type of melons. We pass new settlements being developed for

veterans. The land holdings are small and the houses are very small. There are also fields of tomatoes along here. Part of these are for use fresh, and part for soups and juices.

I notice that overhead irrigation is becoming the dominant method for young citrus, although not for vines. Experience to date does not indicate any greater amount of diseases with the overhead method.

Since water is the limiting factor in this area, the soil is quite carefully selected for irrigation. Growers now favor the relatively sandy soils for their irrigated citrus.

We cross many low, broad, old sand ridges that are now well stabilized. Here these lie generally west to east. In average years, 12 to 20 acres are required per sheep, although less must be carried during droughts. Often many sheep die because the owners try to hold on too long. Mr. Lyon tells me that the last drought brought the sheep population in Australia to below 100,000,000. Now it is more than that. He tells me that the estimated maximum is around 130,000,000. Some are now using irrigated alfalfa to carry their stock during the dry summers.



K-1671 January 28, 1949
 Australia. Southern New South Wales. Several miles
 southeast of Mildura. Overhead irrigation of young
 citrus on "Mallee" soils.



K-1673 January 28, 1949
 Australia. Southern New South Wales. A little
 east of Euston. Severe rabbit damage on "Mallee"
 soils (semi-indurated crôte calcaire at 18 inches).

I look hurriedly at the Mallee soils again about 40 miles out from Mildura. In places they have irregularly indurated *crouê calcaire* at about 12 to 24 inches. Here I see some pastures that are practically barren from severe grazing by rabbits and kangaroos.

Most of the first-bottom soils are very heavy. Some of the higher ones, which are rarely flooded and are somewhat sandy, are irrigated for citrus. These flood plains carry bigger trees ("box"). Some of the local soil types have sand lying over the clay. The older ones have a brown surface soil.

Now it is extremely hot and very dry! About 50 miles from Mildura I look at the soil in a large plain of high terraces within the river flood plain. I should say that this soil lies somewhere between Reddish Chestnut and Reddish-Brown. The rainfall is about 11 inches.

- | | | |
|----------------|---------|--|
| A ₁ | 0-4" | Reddish-brown, heavy, fine sandy loam. Vesicular and faintly platy. |
| B ₂ | 4-13" | Reddish-brown (2.5YR 4/4) fine sandy clay. Well developed angular, medium nut structure. Friable under pressure. Good vertical breakage, giving the soil almost, but not quite, a prismatic structure. |
| B ₃ | 13-15"+ | Like the above, but coarse blocky, and with white specks of lime. |

It is said to be hard to provide drains for this soil.

We pass Euston and go over first bottoms of the Murray River. We stop across the river in Robindale for "lemon squash" and water. This is certainly a hot, dry country. It reminds me of the Imperial Valley in summer. We go south a mile and then southeast on a new road through a new settlement for veterans on a sandy loam type of Mallee soils. Here I see new land clearing and one-year old vines. New irrigation systems are going in, with water pumped from the river.

Along here are some very large, cleared fields formerly used for wheat. Some wheat was grown this year, with yields of around 9 bushels to the acre. The abandoned fields and the stubble land are used for grazing sheep. This area is said to be the very northern edge of the "marginal" wheat area. It is scarcely practicable to attempt it. I note that the tops of the low, reddish-brown, sandy ridges have a very sparse ground cover and a few very shallow blowouts.

At about 6 miles from Euston, the road drops for a short ways into the river flood plain, and the Mallee shrub is replaced by the box. And again at 11 miles we are in the river bottom itself or on the margin of it. And then back onto the main road. There is almost no farm land to

see until we come to Boundary Bend. The road goes mostly along the boundary of the river flood plain and the Mallee soil. Thus, for a long distance there are box trees on the left of the road and Mallee on the southwest side.

Again we are behind schedule and must hurry to get to Swann Hill by 1:00. Mr. Lyon says that east of Swann Hill most irrigation is by gravity. Much of it is by pumping, except for a bit near the city.

Beyond Boundary Bend there are some young orange groves on the higher sandy land of the slopes of the Mallee soils. The cuts in the sand ridges show yellowish-red loamy sand, with slight compaction to some depth and some lime in the lower part. I see some soil blowing on the flats with sandy surfaces along the river, caused by overgrazing. It appears accentuated since the soil material collects around the low shrubs at the same time it is removed from among them.

Fourteen miles south of Boundary Bend I see some more dry-land wheat, and some abandoned wheat fields, on the Mallee soils. The rainfall here is about 15 inches.

There is a very strong wind now. We can see local showers in the distance and little, dusty twisters. A few miles further south, soil is blowing rather badly in one of these fields today. We pass a small dune of sand. Then

there is a gradual increase in the percentage of cleared land used for wheat and pasture. Some is now in fallow. A part is irrigated.

We pass the road junction to Piangil where I see a wheat silo (= grain elevator). Some vegetables are grown here on the heavy soil of the first terrace, with vines and citrus on the upper terrace slopes. There is some winter-irrigated pasture used for the dairying. Irrigation here is on an individual-unit basis and not organized by the community. The heavy soils are dark gray and self-mulching, in contrast to those at Mildura. Mr. Lyon feels a great need to study these heavy soils and distinguish the differences in clay minerals among them.

We pass the small settlement of Wood Wood, with vines, citrus, vegetables, and some wheat and pasture. A bit further south we come into the Nyah settlement, with organized irrigation. The principal crops are citrus and vines, with some pears and few peaches. Wheat and fallow lie above the irrigation.

(Just now it rains very hard.)

Improved land here with vines is held at about 200 pounds per acre, and with citrus at about 400 pounds.

We stop in Nyah for lunch. We are now rather late and don't get on our way until 1:50.

In this community there are about 3,000 acres of irrigated fruit, mostly vines with some citrus and a little other fruit. Going on to Swann Hill I see lots of wheat stubble, and one field not yet harvested, and quite a bit of fallow.

We pass the settlement of Woorinen on the way to Swann Hill. This one has gravitational water out of the Murray River. Vines are the main crop on the higher, sandy soils. There is some poor pasture on the lowland. Some of the old land, especially that with heavy soil, can be reclaimed for vines by growing alfalfa for two or three years after old vines have been removed because of declining vigor. This settlement, unlike the others, is mainly on soils of the river bottoms -- rather high bottoms, but below the Mallee soils.

We have a little delay here while we change cars near Swann Hill. Then we pass into an area based largely on pasture and fodder-crops for dairying, with irrigation. About $1\frac{1}{2}$ acres is needed per cow. Some alfalfa is used, but I see more wheat and clover. The soil is a dark gray, relatively old, self-mulching clay.

We come into Swann Hill at 2:45 p.m., and I leave Mr. Lyon and go on toward Deniliquin with Mr. Butler of the CSIR. Mr. Butler tells me that here at Swann Hill the Mallee



K-1761 January 28, 1949
Australia. Northern Victoria a little west of Swan
Hill. Grapes for drying on brown soils of high
terraces but below the "Mallee" soils.

soils give out and we are to pass into the soil region shown on Prescott's map as "grey and brown soils of heavy texture." Actually most of these are complexes, including internal Solonchak, Solonetz, and solodized-Solonetz. Many of the gray soils are hydromorphic. Throughout the area are many "crab hole" complexes with local micro-relief of various forms.

Just after we cross the Murray River and turn southeast, we pass over outlying areas of the Mallee soils, and then onto an old lake plain with gray, self-mulching clay, covered in places with smears of sand.

At 5 miles beyond Swann Hill, we come to the edge of a great plain developed by a Pleistocene stream from the mountains. Here the Murray River is broken into a number of distributaries. (See the map for this unusual stream pattern.)

At $6\frac{1}{2}$ miles we look at the Niemur clay -- a gray member of the "grey and brown soils of heavy texture." This is on the old Pleistocene flood plain or lake, possibly reworked by rivers. The land is practically level. There is a well-expressed micro-relief of low mounds and swales, with differences in elevation of from 6 to 8 inches at distances of 10 to 30 feet.

A ₁	0-3"	Mottled gray and brownish-gray clay, with reddish-brown streaks from the roots. Very coarsely granular. (Actually, most of the real A ₁ gets washed down into the cracks.) ¹
A ₃	3-5"	Gray to dark gray clay, slightly mottled with brown. Roughly prismatic and suggests columnar. The soil breaks into very hard, medium, angular nut.
B ₂	5-20"	Dark gray, prismatic clay, that falls into angular nut. Some faint brown mottling. Slight evidence of caps at the tops of the columns. Plant roots penetrate.
B ₃	20-30"+	Like the above, but more fine mottling and a few soft, small, dark concretions.

One might possibly regard this as a self-mulching, degraded Solonetz. Mr. Butler thinks that the soil has gone beyond Solonetz. He says that the pH is only a little above neutral.

I notice that the cracks are only about $\frac{1}{2}$ to 2 inches wide in the lower places.

The vegetation here is mostly grass, with some clumps of trees. Mr. Butler says that often there is more timber than here.

This soil resembles rather closely the McKenzie clay.

It certainly is very hot today.

We pass over some low, gently sloping areas of the Mallee soil material. Butler suggests that these Mallee soils may have come from the old Pleistocene coastal dunes, because of the relatively high content of calcium carbonate (?).



K-1674 January 28, 1949

Australia. Southern New South Wales. $6\frac{1}{2}$ miles east of Swan Hill. View on Niemur clay — a gray member of the "brown and grey soils of heavy texture." (Possibly self-mulching degraded Solonetz ?) Note characteristic micro-relief.



K-1676 January 29, 1949

Australia. Southern New South Wales. 9 miles east of Deniliquin. View on soil of Mundiwa family — a solonized Reddish-Chestnut or Reddish-Brown.

This land is used for sheep. Mr. Butler says they use about 3 acres per animal, which seems heavy stocking to me.

About 10 miles from Swann Hill, we look at an unnamed type in the Mundiwa family. The parent material consists of Pleistocene alluvium over old marine sediments. The vegetation consists of the dilon bush, annual grasses (Danthonia), annual weeds, and so on. Patches are bare where the sheep have collected. There are trees along the stream channels. The land is nearly level. The rainfall is about 12 inches. There is no snow, but about 30 or 40 frosts per winter.

I should likely call this a slightly salinized and slightly solonized Reddish-Brown soil.

Sample No. 13

- | | | |
|----------------------|---------|--|
| A _{1&2} | 0-1&1½" | Reddish-gray to light reddish-brown, mottled with shades, clay. Platy. The soil is very hard now and digs out in clods that are friable with difficulty. (5YR 6/3 - light reddish-brown) |
| A ₃ | 1&1½-3" | Transitional. |
| B ₂ | 3-12" | Dark reddish-brown to dark reddish-gray (5YR 4/2 - 3/2) clay. Prismatic structure that falls into hard, sharply angular, medium nut. (5YR 4/2 - dark reddish-gray) |



K-1675 January 28, 1949
 Australia. Southern New South Wales. About
 30 miles southeast of Swan Hill. Micro-relief
 on a slightly saline gray soil of the "brown
 and grey soils of heavy texture."

(The soil is said to be always moist below 12 inches although the surface is very dry. There is no irrigation and the land is too high to be affected by ground water from the river.)

- | | | |
|----------------|---------|--|
| B ₃ | 12-26" | Reddish-brown (5YR 4/4) clay. The structure is destroyed by a large auger. Likely it is coarse, irregular, blocky. |
| C _c | 26-40"+ | Yellowish-red, friable clay, strongly mottled with white. The white material is mainly gypsum, but partly calcium carbonate. With depth, the color fades slightly. The soil is said to be salty in the lower part. (Approx. 5YR 6/4 - light reddish-brown) |

This soil would also be included with Prescott's "grey and brown soil of heavy texture."

There are many transitional soils between the gray ones and the brown ones. Almost all of them have some sort of complex micro-relief. There appear to be no termite mounds on any of these soils.

This is certainly dry-looking country, yet it is remarkable how much vegetation exists on these hard, dry, clayey soils. There are even a good many "black box" -- low trees. But most of these have been ring-barked to give more pasture.

Twenty miles out I look hurriedly at a member of the Moulamein family. This is a nearly level, gray, clayey soil,



K-1762 January 28, 1949
Australia. Southern New South Wales. 20 miles
southeast of Swan Hill. Micro-relief on gray
member (Moulamein family) of "brown and grey
soils of heavy texture." Probably old puff gypsum
Solonchak.

developed on the old Pleistocene lake plain. There is a well-developed mound-and-swale micro-relief. The differences in elevation are about 20 inches, at points 15 to 20 feet apart. The upper places have gypsum crystals on the surface and the soil is somewhat puffed. This looks to me like an old gypsum puff Solonchak.

We pass over another area like sample No. 13, that is more salty. Oats and barley were sown, but the plants have died out in large patches.

Again we must hurry, hurry, and even so we shall be very late. Too much was laid out for one day -- altogether too much. The roads are very dusty, and the dust rolls up bountifully within the truck.

At 35 miles, there are mostly sheep pastures with some attempts at cereals, which have mostly failed.

At about 40 miles from Swann Hill, we see the most easternly extension of the sandy, reddish-brown soils of the Mallee group in low, dune-like swales. These are in cereals or fallow for cereals. At first glance, these suggest a serious hazard of soil blowing, but the soil has enough clay to have a cloddy surface. Sheep are now grazing on the stubble. Butler says that further east the sand hills are free of lime and clay, in contrast to the Mallee soil.

Near Barham there is some irrigation, mostly for fruits, with irrigated pastures on the margins. Here we turn east towards Deniliquin. We cross many dry stream beds of the river flood plains. Some of these have water holes. One is called Calf No. 1 Creek, and another Calf No. 2 Creek -- named, I presume, by a station hand looking for strays.

Ten miles east of Barham, we pass some of the acid sand hills. These have some grass cover and are grazed by sheep. Then, we are back onto soil like sample No. 13.

At 14 miles east of Barham, we pass over to "red-brown earth" -- the Reddish Chestnut soil of the United States or the southern Chernozem of the USSR. Here the grass is better and there are quite a few trees, mainly "black box." (Further east, somewhat similar trees are called "gray box.") Many sheep are grazing here. The rainfall is about 15 inches. The land is nearly level to gently undulating and is likely a low alluvial fan of Pleistocene times. At about 6 or 7 miles more, we are off this area and back on the "grey and brown soils of heavy texture" on a somewhat lower plain. There are fewer trees, except along the old Pleistocene stream courses.

The wind is strong and we drive through a sharp shower at 6:00 p.m. With much rain, this road would be absolutely impassable. Apparently we shall be very late indeed. My poor back!

About 25 miles west of Deniliquin, we come onto a proposed irrigation project in an advanced stage of planning. But the detailed soil survey showed only a few soils that were suitable. The area is mainly brown soil like sample No. 13 of the "grey and brown soils of heavy texture." Here the soil is red, then beyond I see patches of the gray and transitional soils.

In the soil association are spots with an A horizon, along with patches showing the B at the surface. This complex is included in the Billabong series. At the lower levels the soil is gray, has somewhat more micro-relief, and has less salts and these are lower in the profile. Apparently there is more water in the lower places to wash the salts away. These lower soils are included in the Riverina series.

About 10 miles west of Deniliquin, I see some fields used for cereals, but without much success.

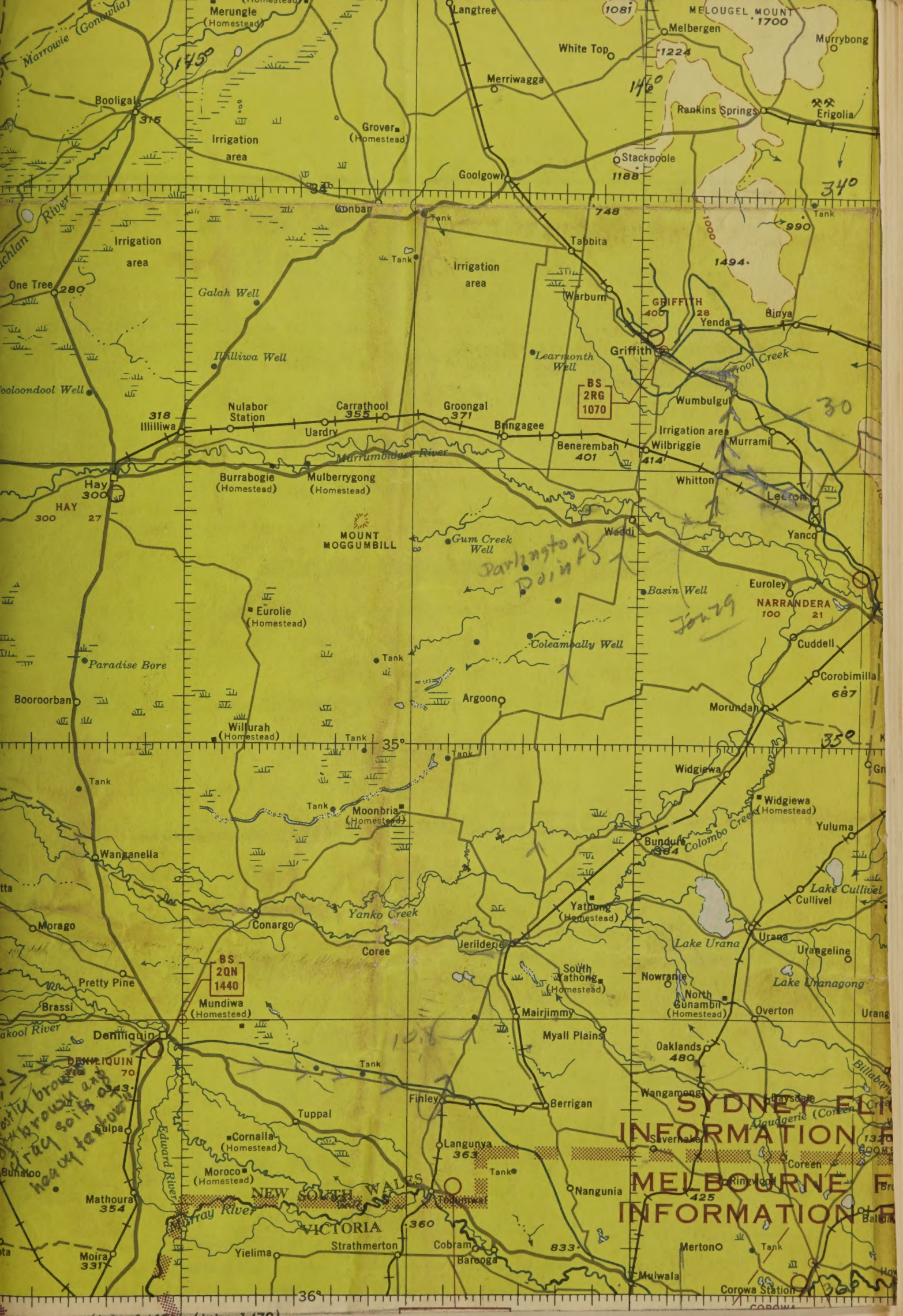
It now begins to get dark. These last 10 miles are very, very long ones indeed. We reach Deniliquin at

7:05 p.m. I stop at the Royal Hotel.^{1/} I just make it into the dining room by not stopping to change. Obviously the waitress doesn't like it at all, but she serves me a cold supper.

Even though occurring in large areas, the "grey and brown soils of heavy texture" seem to me to be distinctly intrazonal. They are nearly level, especially the gray ones, very heavy in texture in the lower part, and imperfectly drained. Taking these altogether, one should scarcely expect any sort of normal soil. Yet, with the rainfall they have, well-developed Solonchak and Solonetz are not common, although a few come close to being a gypsum puff Solonchak. If the rainfall were a bit heavier here, large areas would be swamp. Likely the normal soil is partly Reddish Chestnut and partly Reddish-Brown, depending on the rainfall. The Mallee soils are slightly salinized Reddish-Brown soils where I have seen them. They are not solonized except as induced by irrigation. Of course, this area is further complicated by the low parallel ridges, likely very old dunes of calcareous sandy material.

I go to bed and hope for the best.

^{1/} Added later: Not recommended!



SYDNEY
INFORMATION
MELBOURNE
INFORMATION

only brown and
gray soils
heavy to humus

Darlington
Point

Jan 29

BS
2QN
1440

BS
2RG
1070

MOUNT
MOGGUMBILL

NEW SOUTH WALES

VICTORIA

(24) Denilligora - Griffith

1:1,000,000

AERONAUTICAL SYMBOLS

AIRCRAFT FACILITIES

AIRPORTS—COMPLETE FACILITIES Refueling services, complete repairs, shelter, and (where applicable) passenger or cargo services and/or seaplane ramp with hauling-out facilities.

AIRFIELDS or SEAPLANE PORTS—LIMITED FACILITIES Refueling services for normal traffic and limited repair facilities.

SEAPLANE LANDPLANE

		Military Base
		Civil
		Joint Civil and Military Base

SEAPLANE LANDPLANE

		Military
		Civil
		Joint Civil and Military

LANDING GROUNDS and ANCHORAGES

- Landing Strip—Very limited or no facilities
- Landing Area—Very limited or no facilities or information thereon not complete
- Sheltered Anchorage—Very limited or no facilities
- Emergency Anchorage—Very limited or no facilities or information thereon not complete

AIRFIELD DATA

- 300 Elevation in feet
- L Minimum lighting; obstruction, boundary or runway lights and lighted wind indicator
- H Hard surface runway, normally all-weather
- S Normally sheltered take-off area
- 60 Length of longest runway to nearest hundred feet

ASANSOL
300 LH 60

TARANTO
3 LS 99

When specific information pertaining to landing facility data is lacking, the respective character is replaced by a dash (-).

ASANSOL
300 -H 60

TARANTO
3 -- 99

AIR NAVIGATION LIGHTS

Numerals in italics indicate elevation above mean sea level.

Rotating Light ----- 110 ★

Rotating Light (With flashing code lights) ----- ...★

Rotating Light (With course lights) ----- .15★

Flashing Light ----- ★

Flashing Light (With code) ----- ...★

Obstruction Light ----- ★

Marine Light (Elevations of marine lights are above high water.) ----- Occ WRG ●

Lightship ----- ★

F—Fixed
Fl—Flashing

Occ—Occulting
Alt—Alternating

Gp—Group
R—Red

W—White
G—Green

B—Blue
(U)—Unwatched

SEC—Sector
sec—Second

Marine lights are white unless colors are indicated; alternating lights are red and white unless otherwise indicated.

January 29

I am up for breakfast at 7:00 on this Saturday morning. But regardless of what the manager told me last night, the door to the dining room is locked. Finally I get a little breakfast, but not much.

I leave the hotel at 7:45 with Mr. Butler, and then we go to pick up his wife, who will ride with us too for the next two days. Already the sun is bright and it promises to be extremely hot today.

The rainfall here is 15 inches. We cross the Edward River -- a distributary of the Murray and merely a large, main channel. We go east on gray soil of the "grey and brown soils of heavy texture." These here are said to be intermediate to the "red-brown earth." This is a large, nearly level plain with some irrigated leys and meadows. Trees are only along the water courses. The soils are somewhat saline. The irrigated pastures are mainly subterranean clover and annual rye grass. These are irrigated mostly in the fall and again in the spring. They are very dry in summer. Fat lambs are sold off from them in early summer.

About 5 miles out, the drainage is a bit better. Butler says that the streams that traverse the plain are

of Pleistocene origin and are not part of the modern drainage system. This road to Finley is on the route for driving sheep, and I see flocks folded very tightly for the night.

About 9 miles out, I look at a soil in the Mundiwa family. The land is nearly level. There are some low shrubs. The grasses are largely annuals. There are a few trees in scattered clumps and along the infrequent water courses. I should call this a solonized Reddish Chestnut soil, tending toward the Reddish-Brown. (It is a shame we have to rely so much on the large auger for samples.)

A ₁	0-3"	Reddish-yellow (5YR 6/8), fine sandy loam. Slightly platy. The soil digs out in roughly prismatic clods that are brittle and friable with some pressure.
A ₃	3-6"	Yellowish-red (5YR 5/8), heavy fine sandy loam, finely mottled with shades, and with some brown grass roots. Digs out in large prisms or blocks that are friable with difficulty. Somewhat vesicular.
B ₂	6-22"	Dark reddish-brown (2.5YR 3/4 - 4/4) clay. Prismatic, falling into medium or small angular nut.
B ₃	22-26"	Reddish-brown (5YR 4/4) clay. Somewhat coarser prismatic and blocky. Some carbonates and less clay than in the B ₂ .

C_c 26-30" Strong brown to dark yellowish-brown, finely mottled with shades, fine sandy clay. Easily friable. Some gypsum and quite a bit of fine mica.

Nearby, on the margin of a broad road, I look at a "scald" caused by the close folding of sheep. The very surface soil packs into a smooth sheet as the vegetation is removed and it is tramped by the stock. In the process, some of the fine material is blown out and the remainder puddles. Vegetation will return naturally only very, very slowly. But these can be reclaimed by removal of the stock, furrowing, and seeding.

At about 15 or 16 miles, we pass over to plains with "red-brown earth" or Reddish Chestnut soils. Originally these had a thin forest that has been mostly removed since. Part of the land is irrigated for pasture. This great plain that we have been traversing since Swann Hill has yet essentially no drainage system. Now we are running parallel to the axis of a great alluvial fan and roughly toward its source. Apparently this soil carried only a small amount of grass originally. Mr. Butler says that in the virgin state, 10 acres would be required for one sheep. Now that it is cleared and about one-tenth irrigated, one sheep can be carried per acre. New settlers have each 600 to 700 acres, with about 180 acres irrigated.

By scattering the irrigation, they hope to prevent water-table troubles as well as to spread the benefits. Where water tables do develop high in these soils from irrigation, the water is usually quite fresh, and so does not handicap the pasture seriously, although fruits would be eliminated. The new settler has a right to irrigate one-tenth of his tract and he must pay for this whether he uses it or not. Then, he can buy up to 200 percent of his original water right more. Along here I see a little irrigated Japanese millet.

Thirty-one miles east of Deniliquin, I look at the Finley soil on a nearly level Pleistocene alluvial fan. Originally this area had thin forest and a rainfall of about 17 inches.

A ₁	0-2"	Yellowish-red (5YR 4/6), heavy fine sandy loam. Hard and brittle. The soil digs out in small and medium clods that are friable with some difficulty to fine granular.
A ₃	2-12"	Reddish-brown (5YR 4/4) loam. Somewhat harder than above.
B ₂	12-26"	Dark red (2.5YR 3/6) sandy clay. Hard prismatic that falls to nut.
B ₃	26-30"	Red (2.5YR 4/6) sandy clay. Less hard and less clayey than above.

C_c 30-36"± Red (2.5YR 5/8), rather friable, massive, sandy clay, mottled with white. Plastic only with a lot of working. Many carbonate nodules. This gradually fades into the C, with less lime and less clay.

We reach Finley about 10:00 and stop for a drink. It is very hot, sunny, and dry. Butler suggests that for this area one look at the following: CSIR Bulletin No. 162, The soil and land-use surveys of the Wakoal Irrigation District, New South Wales, Smith et al., 1943; and CSIR Bulletin No. 189, The soils of the Berrequin Irrigation District, New South Wales, Smith, 1943. This includes the roads traversed this morning and part of those to follow.

We drive north over soil like the last one in this great plain. I see some irrigated alfalfa and some irrigated small grains. Part of these fields are getting too little water. Most of the land is used for sheep.

Five miles north of Finley, we look at the Marago type, said to be the first hydromorphic stage of the "red-brown earth." The surface is slightly contorted, with 6-inch mounds about 10 to 12 feet apart. In the lower places are irregular cracks into which some surface soil washes from the low mounds. The tops of the mounds are

nearly bare and the B is exposed along with some calcium carbonate. In the low places, the surface one inch or so is light reddish-brown, underlain by 3 to 4 inches of gray, slightly mottled with brown, vesicular, brittle, fine sandy loam that is friable with some difficulty. There is just a suggestion of platiness. Beneath is dusky red to very dark gray, hard, prismatic clay that falls into coarse blocks. The A gets engulfed in these cracks and thus worked down into the soil.

On the mounds the soil is brown to dark brown (7.5YR 4/2), with rather loose, medium nut to coarse granular structure. In the low places the gypsum comes in at about 30 inches, and not at all on the mounds, although they have calcium carbonate from the surface down.

There is a great deal of this sort of micro-relief in Australia, especially on the nearly level soils. Further study is needed to see the relation of the micro-relief to the ground water.

We see other areas with puff spots rising from the general plains, but without well-defined swales between them.

At about 14 miles beyond Finley, we stop for a moment on the Murray soil, which is like the Finley soil but

heavy beneath. Here there are more cereals and both irrigated and unirrigated pastures. We are gradually moving up the huge fan of the plain and into the "grey and brown soils of heavy texture."

About 19 miles north of Finley, we look at another complex -- a contorted Billabong. The surface soil is brown, perhaps rather grayer in the puff spot and rather browner in the swale or "crab hole." I take a photograph.

Butler says that one strikes water here at about 70 feet. This is salty and there is not much of it. At 100 feet, the water is less salty. They get water good enough for stock at about 120 to 130 feet. We enter Jerilderie. This little town was made famous by Ned Kelley, who robbed the bank. He corraled the police somehow, cut the telegraph lines, and robbed the town in about 1880.

We cross Turn Back Jimmy Creek in the "grey and brown soils of heavy texture." At 23 miles north of Finley, we look at the Billabong soil. The land is nearly level. The vegetation is mostly grass, Stipa (sp.) and Danthonia (sp.). And where no trees were present originally except for Acacia (sp.), the land is about one-quarter covered and three-quarters bare; that is, the plants are widely spaced. The cracks in the soil are about 1/4 to 3/4 inch



K-1677 January 29, 1949
Australia. Southern New South Wales. 19 miles
north of Finley. "Crab hole" in a contorted
Billabong complex (of "brown and grey soils of
heavy texture").



K-1678 January 29, 1949
Australia. Southern New South Wales. About 23
miles north of Finley. View on Billabong soil.
(In group of "brown and grey soils of heavy
texture.") Essentially no natural drainage. (Mr. Butler)



K-1763 January 29, 1949
Australia. Southern New South Wales. 9 miles east
of Deniliquin. "Scald" on solonized Reddish-Chestnut
(Mundiwa family) caused by night parking of sheep.



K-1764 January 29, 1949
Australia. Southern New South Wales. 5 miles north of Finley.
View on the Marago soil. The first hydromorphic stage in the
"red-brown earth." Characteristic micro-relief (crab hole).

across and some 2 to 6 feet apart. This soil is on the flood plain of an old Pleistocene stream and has essentially no drainage. In the area there is a continuum from this soil to the "red-brown earth" with no sharp breaks.

A ₁	0-2"	Light red (2.5YR 6/6) loam. Vesicular, brittle, hard, friable with difficulty.
A ₃	2-3"	Transitional.
B ₂	3-22"	Reddish-brown to dark reddish-brown clay. Grossly prismatic that breaks into imperfect angular nut. Below 12 inches, the soil is moist and the color is dusky red (2.5YR 3/2). There are slight traces of carbonate in the lower part.
B ₃	22-26"	Transitional.
C	26-36"+	Pale brown, mottled with brown, friable, silty clay with gypsum. (The soil often has a great deal of gypsum.)

I look at the Riverina soil, the first stage in hydromorphism after the Billabong, and a gray member of the "grey and brown soils of heavy texture."

A	0-2"	Medium gray, fine sandy loam, mottled with brown. Somewhat platy. Hard and brittle, yet friable without great difficulty.
---	------	---



K-1679 January 29, 1949
 Australia. Southern New South Wales. About 23
 miles north of Finley. View on Billabong soil.
 (In group of "brown and grey soils of heavy texture.")
 Essentially no natural drainage.

- B₂ 2-28" (Moist below 8 inches.) Dark gray clay, roughly prismatic, but falls into coarse, imperfect, angular nut. Roots penetrate. The A₂ horizon falls into the cracks of this one. The soil is harder and the blocks are coarser in depth.
- B₃ 28-32" Slightly lighter shade of medium gray, with brown or light brown weak mottling, tough clay.
- C_s 32-34"+ Grayish-brown (10YR 5/2), massive, tough clay, mottled a little with white from gypsum.

The micro-relief here is said to be a little less than usual for this soil. The height differences are about 2 to 3 inches, and low and high places about 6 to 12 feet apart. There are 2 to 4 inches of A in the slight depressions, but none on the tops. There are no trees except for a few Acacia (sp.) (boree). The surface is one-quarter to one-third covered with grass (Danthonia (sp.)) and some herbs. The soil cracks are about $\frac{1}{4}$ to $\frac{1}{2}$ inch wide.

As I go north, I see several more "scalds" with flat, smooth, hard surfaces after grazing and tramping by stock.

About 25 miles north of Jerilderie, we rise gradually on another old Pleistocene fan. The slope is so gentle as to be imperceptible to the eye. Here there are more

trees and snags from ring-barking. Some of the pastures are badly overgrazed.

Beyond, we see small areas of low sand hills. We turn east 23 miles north of Jerilderie. These hills are covered with pine (Pinus callitris, Murray Pine).

This country since Jerilderie has no irrigation and very little cereal. There is more overgrazing here than I have seen since Mildura.

We go east for a ways and then turn north again, where there is another small sandy area with reddish-brown soil. Then about 3 miles south of Darlington Point, we are again back on the "grey and brown soils of heavy texture." We turn east. There is considerable irrigation with paddy rice and wheat. The soil lies between the "red-brown earth" and the brown member of the "grey and brown soils of heavy texture." There are also dry pastures for grazing sheep. Returned soldiers are being settled here. The Commonwealth Government subsidizes the cost over and above the part that can be passed on to the settler on a basis of the productivity of his unit. I see a little irrigated grain sorghum. After traveling for a ways over a small area of the heavy gray soil used for sheep pasture, we are back on the "red-brown earth" (= Reddish Chestnut).

At 2 miles south of Whitton, we turn east toward Leeton. There is some irrigation, but the larger part of the land is in dry sheep grazing. As we go along, I see partially irrigated cereals and pastures; and then some more rice and a little sweet corn. As we approach Leeton, there are irrigated apricots, peaches, and pears. The stubble of the partially irrigated cereals is being grazed by sheep.

As we come quite near the town, the soil is more red. This is used for irrigated apricots, pears, citrus, vines, and peaches.

We reach Leeton at 6:00 p.m. By hurriedly washing and changing, I get into the dining room just before closing. These hotels are certainly run for their own convenience rather than for that of the traveler.

In the evening I go with the Butler's to the home of a friend, Mr. England, and drink ice water in a very hot and very little parlor for an hour or so. Then back to the hotel and to bed.

January 30

I am not up until 7:00 this morning! This day will be another blisterer. Since it is Sunday, breakfast cannot be had until 8:30. We leave at 9:10 a.m. and go west of Leeton over the road traveled last evening. Thirteen miles west, we turn north toward Griffith. There is partially irrigated cereal and pasture on soils transitional between the "red-brown earth" and the brown member of the "grey and brown soils of heavy texture." Some rice is also grown. The rice and fruits don't go together well. Flooding the rice raises the water table, without hurting the rice but with injury to fruits. Then again we cross patches of the "grey and brown soils of heavy texture." The lower ones are used mainly for dry sheep grazing.

About 8 miles south of the main road east of Griffith, we pass some red residual soil from quartzite. This is a Lithosol -- a small island in the old plain. Other such islands may be seen ahead and to each side of us. These are thinly wooded and used for sheep pasture. The local colluvial slopes on these quartzitic hills have loamy red soils.

About 11 miles east of Griffith, we turn toward Griffith. Here there are partly irrigated pastures and

cereals again, with some rice. About 5 miles east of Griffith, we come onto "red-brown earth" with irrigated fruits: apricots, peaches, citrus, vines, and pears.

We reach Griffith at 10:00. The Butler's return home and I wait in the air station for my plane to Sydney. I am graciously served several cups of tea. The bus takes me to the airport and we are away at 11:55 a.m. The great plain stretches out as far as one can see to the southwest and ahead for a long way. The small fruit farms are clustered near the villages; and away from them, the irrigated pastures and rice paddocks are dotted among the cereal stubble and dry pastures. Some fallow extends to the low hills north of our route. A rather large part of this land is irrigated. About 15 miles out, it is dry sheep pasture with a little dry cereal and partial irrigation to the south of us. At about 25 miles, the percentage of dry farming increases along with some partial irrigation. The general pattern, without irrigation, of some cereal, some fallow, and sheep pasture, continues for a long distance. Many of the pastures have a few green trees left from the ring-barking. At about 80 miles, there are fair-sized tracts of solid woodland in the unfavored places.

Somewhat before Adelong, the land gets rough. There is mostly very thinly wooded grazing land. There is some dark-colored woodland on the higher hills, with small gullies that appear to have been started by overgrazing.

We stop at Canberra for a few moments and then are down in Sydney at 2:35 p.m. It is very hot, even in the plane before landing. I take the long bus ride into the city and go to the Wentworth Hotel.

I can't recall ever appreciating a good hotel room more than I do this one. Finally I get at least a part of the dust from the "grey and brown soils of heavy texture" washed away. I pick up the laundry, maps, and film I left here and repack my bags to go to New Zealand. These I take to the air station, since I must be away very early in the morning.

I have dinner with Professor Robinson and Mr. Brewer, and then go early to bed.

I'm very pleased with the work in Australia. Certainly there is a great deal to be done. But a lot is known and methods are developing as rapidly as one has any right to expect. Like elsewhere, more public realization of the need and use of soil-research work must be achieved.

January 31

The porter awakes me at 3:30 by bringing me tea. He drops it on my bedstand and leaves immediately. As soon as I get up, I discover he dropped it on my glasses and broke one lens!

I go immediately to the uptown air station, where I meet Mr. Taylor and Professor Robinson, and we go to the flying boat base. Then we have our tickets examined, and consult with the immigration officials and the customs inspectors. I am softened a bit by a cup of coffee.

We get on the aircraft -- a large flying boat -- at 6:20 a.m. As we leave Australia, I add up the mileage by car, bus, and plane; 12,212 miles since I landed in Sydney on January 11. We have a long taxi on the water of Sydney harbor, and are finally in the air for Auckland at 6:45 a.m.

This has been a splendid tour for such a fast one. Mr. Stephens knows my interests well!

I'm very pleased with the work in Australia. Certainly there is a great deal to be done. But a lot is known and methods are developing as rapidly as one has any right to expect. Like elsewhere, more public realization of the need and use of soil-research work must be somehow stimulated.

With the good staff already at work, more students and trainees -- young men with good fundamental training -- could be used to advantage. There is a lot of land to be investigated and, I'm confident, a great deal more can be done with it in terms of food production and efficiency of use, especially, perhaps, in Queensland.

Added later:

The following are a few interesting books on Australia that I read before I finished these notes:

Wood, Thomas. Cobbers. Oxford. 288pp. 1934-47.
(An interesting travel account.)

Dark, Eleanor. The timeless land. Collens. London. 447 pp. 1946. (A historical novel of early settlement at Sydney.)

Herbert, Xavier. Capricornia. Sydney. London. 510 pp. 1938-47. (A "rough" novel of the northern coast, near Darwin.)

Hill, Ernestine. The great Australian loneliness. Melbourne. 346 pp. 1940-48. (A good travel book of the open places, especially the north, by a newspaper woman.)

Haskell, Arnold L. Waltzing Matilda: a background to Australia. London. 295 pp. 1940-46.
(A travel book, mostly about cities, with some interesting stories, but a bit "stuffy" in places.)

Gunn, Mrs. Aeneas. We of the never never. Melbourne. 253 pp. 1907-48. (A story of life on a cattle station in the Northern Territory. A school classic -- a little sticky in places, but good.)

Trumble, H. C. Blades of grass. 394 pp. Melbourne n.d. c. 1947. (Partly travel, partly agronomy, partly cricket, partly biography, by an eager agronomist.)

Notes from C. G. Stephens, or based on his comments.

- 1* (page 19). "I don't think Prescott ever used the terminology 'coastal podsol' -- I believe Queenslanders do."
- 2* (page 27). "In general Prescott used the word podsol to include podsoles and podsollic soils together, following, I believe, the original Russian usage. His failure to separate the lithosolic soils in his podsol zone was due, I believe, to lack of data on which to base such separation and a recognition that such soils would be podsollic lithosols anyway."
- 3* (page 78). "Rainfalls at Innisfail and Babinda are officially 143 and 163 inches."
- 4* (page 86). Stephens says for grazing when water is low!
- 5* (page 86). Stephens says not. (5* also on page 87.)
- 6* (page 86). Stephens says Red-Yellow Podzolic soils.
- 7* (page 98). Stephens says cost of clearing and development of good pastures are more important.
- 8* (page 133). Stephens says "Mountain Ash" (E. regnans) of Victoria and Tasmania is as large.
- 9* (page 137). "Your repeated reference to 'sand smears over laterite' leaves the impression that sand has been spread over the laterite after its exposure. We have, on the other hand, good evidence from a number of localities in southern Australia that the sand is the remnant of much more extensive cover forming the original A horizons over the laterite. Northcote's study of the Eleanor sand on Kangaroo Island was specifically undertaken to test this point and his results conclusively show that the sand belongs to the soil profile bearing the laterite and it is cogenetic with the laterite. On the other hand, Bryan has accumulated evidence that in Queensland the laterites were associated with red soils rather than grey sands." (I didn't have an opportunity to distinguish all cases. Some smears were genetic; many definitely were not. C.E.K.)

10* (page 144). "The bulk of the evidence indicates that the texture difference between surface and subsoil is pedogenic and not geologic in origin. These solonetzic soils occur in all states in quite a variety of topographic situations from basinlike to 5-degree slopes, on a variety of parent materials and with consistent texture difference and sharpness of horizons between the A and B. Mechanical analyses support horizon relationship."

